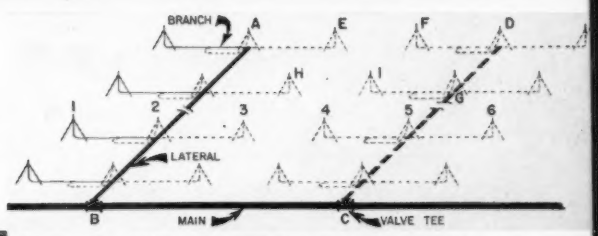
NOVEMBER 1957

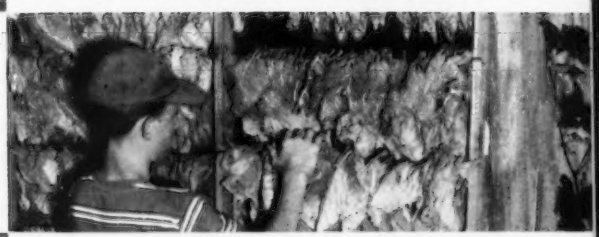
Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

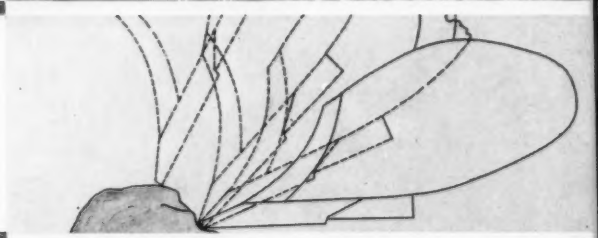
Flexible Tubing in Sprinkler Irrigation | 794



Harvesting and Curing Aromatic Tobacco | 800

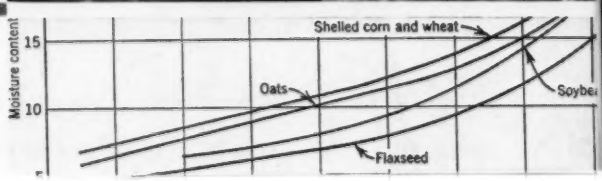


Individual Spring-Release Beams for Moldboard Plows | 804



Density: A Tool in Silo Research | 806

Grain Moisture Indicator | 808

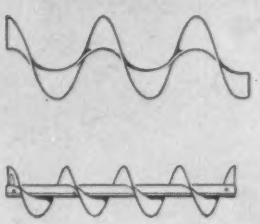


How LINK-BELT makes it easy to **work augers into your design**

THIS JOHN DEERE NO. 14-T TWINE-TIE BALER with Bale Ejector Attachment, incorporates one of the many types of Link-Belt augers designed for farm machinery.

WHERE augers are a vital part of any equipment, here's the sure way to better equipment design. Link-Belt augers are available in a full range of diameters, gauges and pitches . . . in any suitable metal to meet your most exacting requirements. And they're simple and compact, accurately made to insure dependable operation.

For any design problem involving augers ask the Link-Belt office near you for engineering assistance.



SELECTED FLIGHTING for all your auger needs. Helicoid, sectional or a range of other types are available in the metal and finish best suited for your design.

SIMPLICITY OF CONSTRUCTION and sturdy design of Link-Belt augers provide dependable, efficient operation on your machine. One basic assembly — no other moving parts to break down.

YOUR CHOICE OF METALS answers your requirements for handling corrosive or abrasive materials. And Link-Belt uses only specially selected steels.

ENGINEERING SERVICES. Our auger specialists will help to analyze your special needs . . . integrate all elements of your design for overall system efficiency.

ALL COMPONENTS — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, drives—are available for every design.

LINK-BELT

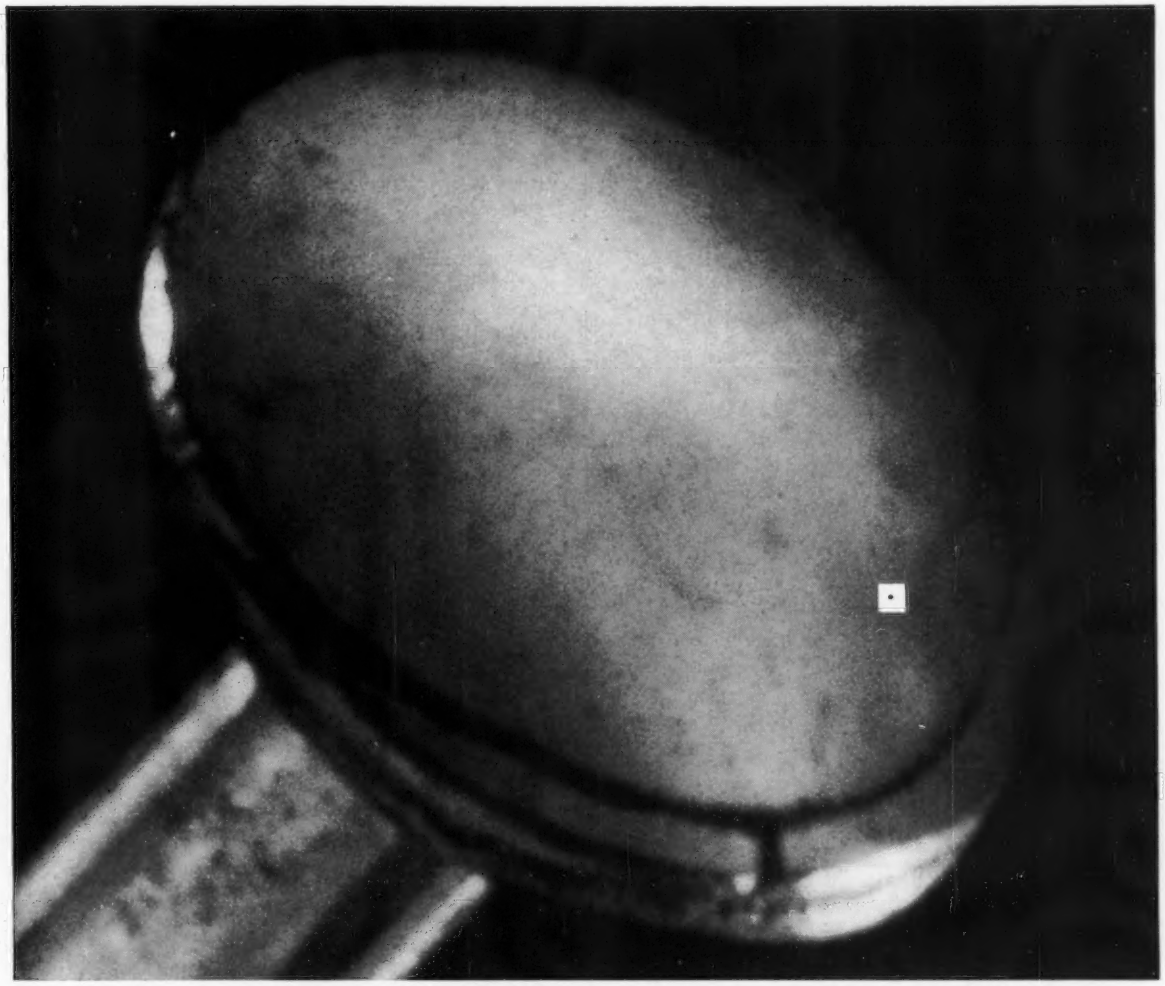
FARM MACHINE AUGERS

Get in touch with the nearest Link-Belt office for your copy of Screw Conveyor Data Book 2289 . . . today.

14,727

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

For more facts circle No. 77 on reply card



Head of a common pin, enlarged 100 times. The black speck within the white square is approximately 1000 microns.

Micron on a pinhead!

It takes twenty microns to be visible to the naked eye. There are twenty-five of them in each white blood cell in your veins.

But a micron is too *large* for measurement in some of the filtration Purolator is doing today.

It's a fact. Some of our filters have to remove particles that are sub-micronic in size. That's how far we've come in keeping pace with today's demand for better performance and longer life in industrial equipment and consumer goods. As a result, precision fits, closer running clearances, smoother surface finishes and far more effective quality control are the rule . . . and this trend is continuing. That's why it is important that the potential savings be clearly understood by the people responsible for important decisions in this field.

Application of our engineering skill to the widest diversity of filtration problems for more than three decades has provided us with a unique experience. Whatever filtration problem industry runs into . . . chances are we've already solved it.

Filtration For Every Known Fluid

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

For more facts circle No. 51 on reply card

Agricultural Engineering

Established 1920

CONTENTS • NOVEMBER, 1957 • Vol. 38, No. 11

Report to Readers 783

Engineer Shortage 793

Flexible Tubing in Sprinkler Irrigation 794
Herman Bouwer and J. O. Helms

Harvesting and Curing Aromatic Tobacco 800
R. L. Shaw, V. H. Baker and McNeil Marshall

Individual Spring-Release Beams for Moldboard Plows . 804
R. T. Brown

Density: A Tool in Silo Research 806
C. K. Otis and J. H. Pomroy

Grain Moisture Indicator 808
W. V. Hukill

News Section 809

Technical Paper Abstracts 816

Winter Meeting Preview 818

Manufacturers' Literature 820

Index to Advertisers 834

Note: AGRICULTURAL ENGINEERING is regularly indexed by Engineering Index and by Agricultural Index. Volumes of AGRICULTURAL ENGINEERING, in microfilm form, are available (beginning with Vol. 32, 1951), and inquiries concerning purchase should be directed to University Microfilms, 313 North First Street, Ann Arbor, Michigan.

AGRICULTURAL ENGINEERING is owned and published monthly by the American Society of Agricultural Engineers. Editorial, subscription and advertising departments are at the central office of the Society, 420 Main St., St. Joseph, Mich. (Telephone: YUkon 3-2700).

JAMES BASSELMAN, *Editor and Publisher*

OFFICERS AND COUNCIL

American Society of Agricultural Engineers

EARL D. ANDERSON, *President*

Vice-Presidents	*Councilors*	*Past-Presidents*
W. J. Ridout, Jr.	G. E. Henderson	Roy Bainer
Lloyd W. Hurlbut	David C. Sprague	Wayne H. Worthington
Henry J. Barre	George M. Eveleth	

JIMMY L. BUTT, *Secretary*

RALPH A. PALMER, *Treasurer and Assistant Secretary*

RAYMOND OLNEY, *Counselor*

Central Office: 420 Main Street, St. Joseph, Michigan

SUBSCRIPTION PRICE: $5.00 a year, plus an extra postage charge to all countries to which the second-class postage rate does not apply; to ASAE members anywhere, $3.00 a year. Single copies (current), 50 cents each.

POST OFFICE ENTRY: Entered as second-class matter, October 28, 1933, at the post office at Benton Harbor, Michigan, under the Act of August 24, 1912. Additional entry at St. Joseph, Michigan. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921.

The American Society of Agricultural Engineers is not responsible for statements and opinions advanced in its meetings or printed in its publications; they represent the views of the individuals to whom they are credited and are not binding on the society as a whole.

TITLE: The title AGRICULTURAL ENGINEERING is registered in the United States Patent Office.

COPYRIGHT: Copyright, 1957, by the American Society of Agricultural Engineers.

Reprints may be made from this publication on condition that full credit be given AGRICULTURAL ENGINEERING and the author, and that date of publication be stated.

AGRICULTURAL ENGINEERING is a member of the Audit Bureau of Circulations.

Membership Month Successful

RESULTS of the Society's first Membership Month are very encouraging. Measured in terms of applications received, Membership Month (October) showed 70 applications compared with 27 for October of 1956, and 24 and 29 for August and September, 1957, respectively.

More important, Membership Month marked the inauguration of active membership efforts in several ASAE sections. The Southeast and Southwest Sections have challenged one another to a membership contest to be culminated at the February joint meeting of the two sections. The Mid-Central and Quad City Sections have begun active 1957-58 membership drives. The Pacific Northwest Section intensified its already active membership efforts. Several state and local sections have reported increased membership activities and the appointment of membership committees.

The effects of Membership Month should be felt throughout the Society year through increased awareness by members of the value of a continuing membership activity as a necessary adjunct to a more useful Society with increased services and benefits to all members.

By any of these measuring sticks, the Society's first Membership Month must be regarded as a highly successful undertaking.

5000 Members

THE Goal of "Fifty-hundred members in our Fiftieth year" has been achieved! On November 4, 5033 members were on record. This figure, however, does not include applications being processed; nor does it allow for normal drops and resignations which will become effective on December 31. Whether ASAE is permanently beyond the 5000-mark will depend upon membership activities during the balance of the year, and upon the actual number of drops and resignations on December 31.

Nevertheless, it is a tribute to the efforts of the many ASAE Membership Committees that the goal set in June, 1956, by Roy Bainer, in his presidential inaugural address, has been achieved!

Special Sessions

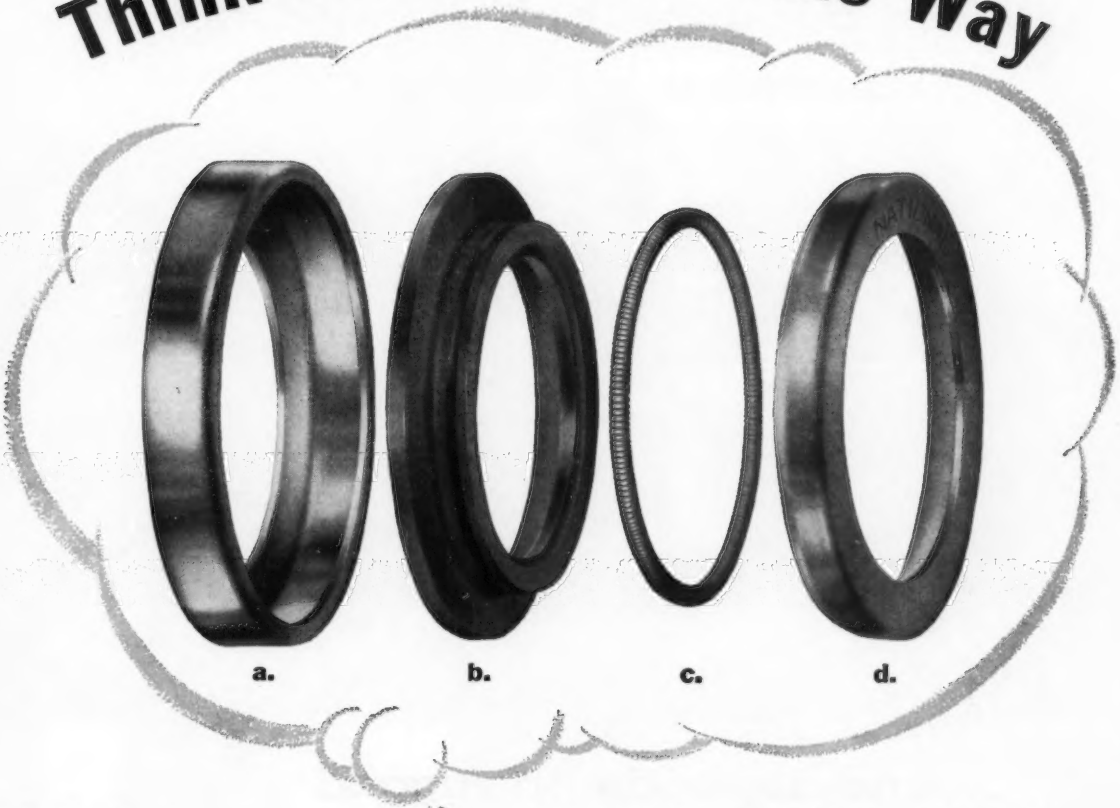
SPECIAL sessions will be held Monday afternoon and evening, December 16, in conjunction with the Winter Meeting Program. The Farm Structures Division will have its annual Milker, starting with a get-acquainted time at 4:15. A movie called "The Salesman" will be shown and a talk, entitled "Peanuts" will be given by Cloyd Steinmetz, director of sales training, Reynolds Metals Co. A dairy smorgasbuffet will be served at 5:30.

Monday evening the committee on farm work efficiency will hold a special program. Subjects to be discussed will be on energy expenditure and farm work efficiency, vibration as a psychological factor in work efficiency, and sociological aspects of farm work efficiency. Concurrently, the committee on extension will conduct a demonstration of the technique of "brainstorming" or creative thinking by groups. This demonstration will show how to stimulate people to develop new ideas and put them to work.

Changes in the ASAE Constitution will be considered at a special business meeting scheduled for Tuesday, Dec. 17, at 4:00 p.m. See page 818 for Winter Meeting Preview.

When you design-in seals

Think of Oil Seals This Way



a. Outer Case

Formed to extreme close tolerance of heavy gauge steel with sufficient structural strength to maintain precision dimension.

b. Sealing Lip

Properly prescribed material either compounded or processed for application conditions of temperature and eccentricities. Precisely molded for correct shaft interference, low torque and positive sealing.

c. Tension Spring

Carefully engineered as to metallurgy, heat treatment and coil diameter to provide uniform compressive force on the sealing element.

d. Inner Case

Strengthens, protects; sturdy gauge steel formed to close tolerances.

4227

A good oil seal is a carefully engineered, precision manufactured assembly of carefully engineered, precision manufactured components. Each part must be exactly right *for the given application* or the seal will not function properly.

You avoid dangers of costly retooling, remanufacture or premature replacement when seals are correctly specified during your product's design stage. Each sealing application is different; many designers use National's field engineering service to be sure correct—and latest—oil seals are used.

Why "do it yourself?" Call the National Seal field engineer now. His service involves no obligation.

NATIONAL SEAL
DIVISION, Federal-Mogul-Bower Bearings, Inc.
GENERAL OFFICES: Redwood City, California
PLANTS: Van Wert, Ohio, Redwood City and Downey, California

CATALOGS (S) IN SWEET'S

36th year

CHICAGO, ILL. . . *Room 462, McCormick Building, HArrison 7-5163*
CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DETROIT, MICH. . . . . *13836 Puritan Avenue, VErmont 6-1909*
DOWNEY (Los Angeles County), CALIF. . . *11634 Patton Road, TOpaz 2-8163*
INDIANAPOLIS, INDIANA . *2802 North Delaware Street, WAlnut 3-1535*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . . . . *1180 Raymond Blvd., MItchell 2-7586*

For more facts circle No. 60 on reply card

Giant combine helps speed rice to America's tables...

...and depends on rugged

TIMKEN-DETROIT® DRIVING ASSEMBLY

for outstanding performance!

This advanced self-propelled combine makes the once long, tough job of rice harvesting an amazingly fast, easy operation. Equipped with Timken-Detroit driving assembly, it is another outstanding example of winning teamwork between leading builders of farm equipment and Timken-Detroit.

The driving assembly used here is a "customized" unit from Timken-Detroit's complete line of axles and brakes for farm equipment. By modifying a standard assembly to meet the builder's needs and specifications, Timken-Detroit engineers were able to provide the exact driving unit needed for this modern rice combine—and at the same time speed its production and eliminate the expense of additional manufacturing facilities.

If you have a problem in designing or building driving assemblies for farm equipment, call in the leader, Timken-Detroit. Our engineers can help you meet your requirements with either units already being manufactured—or with components built to your exact specifications. You'll save time, trouble and money. Write today for complete information.

Plants at: Detroit, Michigan
Oshkosh, Wisconsin • Utica, New York • Ashtabula, Kenton and Newark, Ohio
New Castle, Pennsylvania

TIMKEN Detroit AXLES
ROCKWELL SPRING AND AXLE COMPANY
Accepted RSA Standard

© 1957, RS&A Company

PRODUCTS OF ROCKWELL SPRING AND AXLE CO.

BCA "package units"

. . . bring ball bearing costs down to practical levels

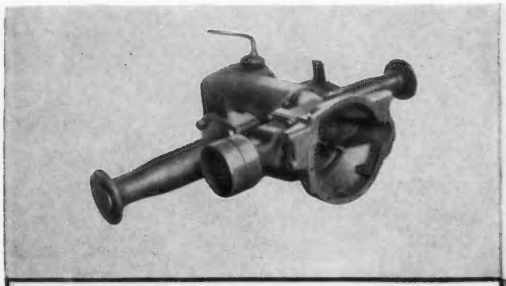
Specifically designed for agricultural service, BCA pre-lubricated "package units" simplify installation problems . . . reduce maintenance . . . and, in addition, are priced at practical levels. Pioneer in this field, BCA is prepared to help with ball bearing engineering and design problems and can supply the bearings you need in sample or production lots. Bearings Company of America Division, Federal-Mogul-Bower Bearings, Inc., Lancaster, Pa.

BCA IDLER PULLEY ASSEMBLIES— pulley, bearing and seal complete in "package unit." Pre-lubricated bearing effectively sealed against dust and grit. Simple, rugged construction eliminates frequent field servicing. Adaptable to combines, forage harvesters, corn pickers, hay balers, grain elevators, cotton pickers. Idler design can be varied for use with flat belts, V-belts or chains.

Free!...BCA "Engineering Handbook." Available to engineers without cost. Write on your company letterhead.

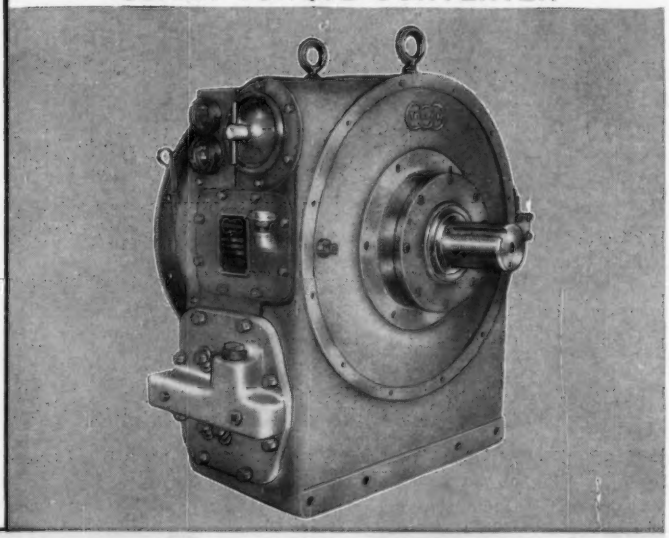
BCA

BEARINGS COMPANY OF AMERICA
DIVISION OF
Federal-Mogul-Bower Bearings, Inc.



How to Solve a Leadership Problem

CLARK TORQUE CONVERTER



Every industry has one leader—and several others who would like to be; which creates the world's finest tonic—competition.

In that relentless tussle to build the best product, then to keep it first, Clark plays an interesting supporting part—

- a number of aggressive builders of agricultural and industrial machines have used Clark engineering to design integrated power-train units to meet specific functional needs of particular machines—new or redesigned models.

That intelligent cooperation has established two facts:

1. Between fly wheel and drive wheels is an area vital to leadership performance
2. Every Clark power train has proved a satisfactory answer to a leadership problem.

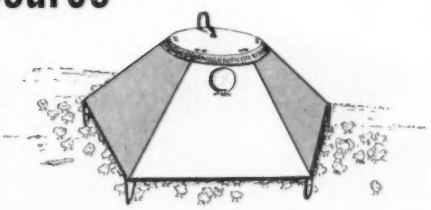
Good idea: Talk to Power Train Headquarters

Send for attractive pocket-size booklet "Products of Clark".

CLARK EQUIPMENT COMPANY
JACKSON 1, MICHIGAN
Other Plants: Buchanan, Battle Creek, Benton Harbor, Michigan

CLARK EQUIPMENT

Why Armco ALUMINIZED STEEL Assures Top Efficiency in Heat Reflectors



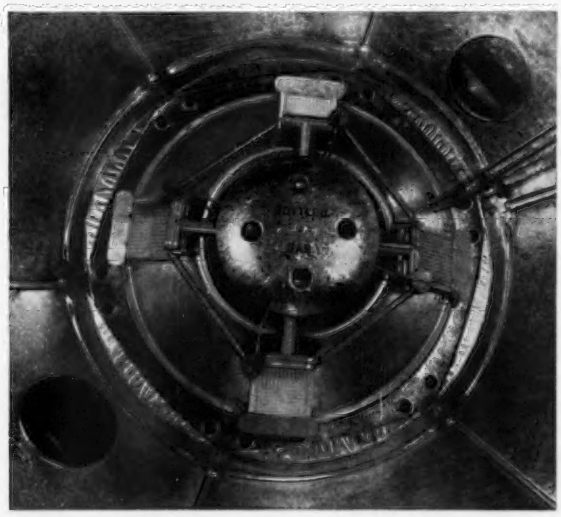
When you design equipment that utilizes heat, a superior reflector means increased efficiency. It also means that you can design for *even distribution* of heat.

These are just a few of the reasons why the largest manufacturer of poultry brooders changed from aluminum painted steel to Armco ALUMINIZED STEEL® for reflector plates above the gas burners. Up to 900 F, this special hot-dip aluminum coated steel reflects approximately 80 per cent of radiant heat.

TOP CORROSION RESISTANCE

Along with its outstanding reflective properties, Armco ALUMINIZED STEEL offers excellent resistance to atmospheric corrosion. Tests show that its aluminum coating outlasts a standard zinc coating on commercial galvanized sheets at least three to one. Thus, when brooders and similar equipment are not in use, iron oxides don't collect on the reflectors to impair their efficiency.

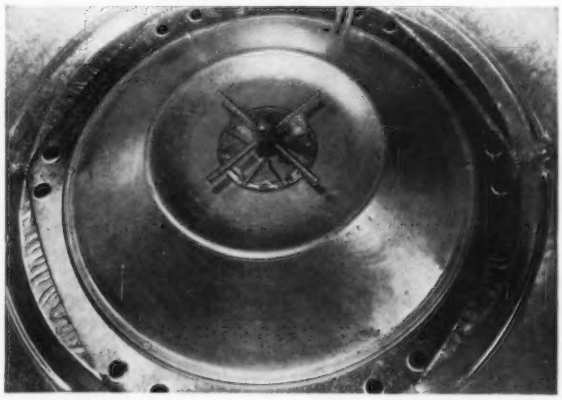
STRENGTH OF STEEL



Armco ALUMINIZED STEEL reflector plate supports heater assembly.

Because ALUMINIZED STEEL combines its heat reflective and corrosion-resisting advantages with the strength of steel, the brooder's reflector plate serves as a structural part, too. It rigidly supports the entire heater assembly. Flash tubes, gas lines, and other parts stay in alignment.

EASILY FORMED BY SPINNING



Coating on Armco ALUMINIZED STEEL withstands severe spinning operation.

Reflector plates are easily formed by spinning. The aluminum coating remains intact. Tests show that the coating retains its excellent characteristics after spinning.

WRITE US FOR INFORMATION

For complete information on Armco ALUMINIZED STEEL, just fill in and mail the coupon. Our engineers will gladly work with you on design problems.

ARMCO STEEL CORPORATION
1237 Curtis Street, Middletown, Ohio
Send me information on Armco ALUMINIZED STEEL
We manufacture_____
Name_____
Company_____
Street_____
City_____ Zone____ State_____

ARMCO STEEL CORPORATION

1237 Curtis Street, Middletown, Ohio

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

For more facts circle No. 56 on reply card

THE HEAVIER THE LOAD...

the more you need HYATTS . . . because nothing else can equal straight cylindrical roller bearings for sheer load-carrying capacity. That's why many of the world's largest crawler tractors are equipped with HYATT Hy-Rolls.

THE HIGHER THE SPEED...

the more you need HYATTS . . . because they are precision-built with painstaking control of internal clearances to run smoothly even at 40,000 rpm, as in this Solar portable gas turbine pump developed for fighting fires.

Cylindrical

THE MORE YOU NEED HY-ROLL BEARINGS

Heavier loads and higher speeds, which must often be accommodated in more compact housings than ever before, are causing problems for many a design engineer these days. If you're among those who are finding that previously-used bearings are no longer good enough, *it's time to switch to HYATTS.* In America's most complete line of straight cylindrical roller bearings you'll find space-saving separable types with ample capacity to carry your radial loads, or flanged race types which will take a surprising amount of thrust. When you lay in HYATT Hy-Rolls you make *sure* of longer, smoother performance at the lowest cost per hour of service. Ask your nearest HYATT Sales Engineer for recommendations —you'll find him mighty helpful! Hyatt Bearings Division, General Motors Corporation, Harrison, N.J.; Pittsburgh; Detroit; Chicago; and Oakland, California.

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

GM FORWARD FROM EIGHTY

HYATT HY-ROLL BEARINGS

THE "WORKHORSES" OF MODERN INDUSTRY

For more facts circle No. 56 on reply card

Report to Readers . . .

RESEARCH BREAKTHROUGH SEEN IN A NEW METHOD OF ELECTRICAL SEED TREATMENT

New methods capable of greater control than has been possible up to this time, in the shock treatment of seeds, have opened up as the result of the invention of an electrical device by USDA agricultural engineer O A Brown and associates. The purpose of the device is to study the effects of low-frequency electrical energy in the treating of seeds. . . . A working model of the device is said to have given uniform results in repeated experiments in the treatment of corn. Germination could be speeded up or retarded at will, and it was possible to increase the water sorption. . . . The selective possibilities of this device are of comparable importance. Being simple in design and low cost in operation, its use is likely to be facilitated in the treatment of seed for such purposes as drying, processing, or destroying weed seed embryos. Being adaptable to either high or low-frequency current, this new device will make possible broad studies of the effects of radiation on seed and the application of treatments for specific purposes.

INSTANT HAND STARTING OF DIESEL ENGINE POSSIBLE WITH NEW DEVICE

A hand starter for diesel engines, to replace the regular electric-starting devices, is indeed news. Actually it is a revolutionary development. But such an invention, called "Instarta," has been placed on the market by a British company. . . . The system employed in this new accessory is that of building up a store of kinetic energy which, when released for starting the engine, is transmitted to the flywheel. An efficiency of 97 percent for the device is claimed in the transmission of the accumulated kinetic energy to the flywheel. . . . The makers say this starter will outlive the engine to which it is fitted, also that it is equally efficient under extremes of climate. Another thing, it may be readily fitted as a replacement for regular electrical equipment on diesel engines now in service, without the necessity of modifying them.

NOW YOU CAN MOLD EYE APPEAL INTO ANY CONCRETE SURFACE

One great urge impelling today's creators of the better things of life is to achieve eye appeal in the designs and products they develop. One place where a lift to our aesthetic sensibilities has been greatly needed is in concrete surfaces. However, it is only fair to say that there has been much progress in this direction in recent years, as anyone with eyes to see well knows. . . . But the thing that strikes us as having the greatest possibilities yet in this area is the development, announced recently by the Portland Cement Association, of plastic and rubber form liners which will make possible an almost limitless variety of new textures and patterns for concrete surfaces. PCA says these liners produce sharp, crisp patterns and a smooth, almost glassy surface, requiring no cleandown, grinding or finishing. The liners are relatively low in cost, are reusable, and need no form oil or bond breaker. Also, no special concrete mix is necessary for good results. . . . This development is a truly great achievement, and incidentally should prove a great boon to the cement and construction industries.

MOW STORAGE OF CHOPPED HAY IS MADE EASIER BY MECHANIZATION

Not one, but <u>three</u> labor-saving and cost-cutting devices for putting chopped hay into barn storage have been developed during the past two years by engineers of Cornell University's agricultural engineering department. These three devices include: (1) a 10-inch-diameter tube in which the conveyor belt, operating at a speed of 1,000 fpm, elevates the chopped hay into the mow; (2) a standard bale elevator (<u>a</u>) with the addition of flared sideboards and metal hold-down strips the full length of the trough, (<u>b</u>) with chains speeded

up, (c) with the standard chain-drag feeder replaced with a wide straight-line conveyor, and (d) with a power-treading device added at the boot end of the elevator, and (3) a conveyor distributor unit that permits putting chopped hay in the mow exactly where it is wanted. . . . None of this equipment is as yet in commercial production; usually it takes an active farmer demand to create manufacturer confidence in a potential market. . . . This development is typical of what engineers in the agricultural engineering divisions of the state agricultural experiment stations and of the federal department of agriculture are continually doing to advance development of labor-saving and cost-cutting ways and means of benefit to the farming industry.

A POLE-TYPE FARM BUILDING OF ALL-STEEL CONSTRUCTION

The wide popularity of the pole-type building has been one of the major developments in farm building construction in recent years. And now the popularity of this type of construction bids fair to be still further enhanced by the new pole-type structure, of all-steel construction, recently placed on the market by Stran-Steel. Available in a wide range of sizes, the structure is adapted to a variety of uses - livestock feeding shelter, loose-housing of dairy animals, machinery storage, all-purpose shed, etc. . . . A particular advantage of the building is the ease with which it can be erected, the key to which is the self-leveling structural feature, an adjustable telescoping arrangement of the steel columns. After the columns are placed in the ground, they are adjusted to correct construction irregularities, and then secured with locking nuts. By pouring concrete into the hole around the base of each column, and into the column cavity, a permanent plumb is secured with no possibility of the racking and sagging characteristic of wood-pole buildings. Besides its basic simplicity of construction, the building is attractively trim and modern in appearance.

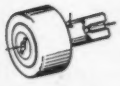
GOOD TEAM: UPSTREAM FLOOD PREVENTION + DOWNSTREAM FLOOD CONTROL

A start of much greater significance than is perhaps generally recognized, toward minimizing the destructive and costly effects of floods, both in rural and urban areas, was made when Congress set up the "Small Watershed Program" in 1954. This two-pronged activity includes the USDA upstream flood-prevention program - a combination of land treatments such as contouring, terracing, crop rotations, and other vegetative and mechanical measures, with a system of flood-prevention structures. The two-fold aim of this part of the program is flood prevention (on small tributaries) and soil and water conservation. . . . The other prong of the activity - downstream flood control - is conducted by the Corps of Engineers of the U S Army. . . . Each project under the over-all program must be initiated by interested people within the individual watershed. It is, in fact, a local undertaking with federal aid, and not a federal project with local backing. . . . When it is considered that the annual loss to agriculture, due to floodwater and sediment, amounts to over a half billion dollars, according to the USDA - and, also, since a large portion of this toll occurs upstream in tributary or head waters - the upstream-downstream flood-control program takes on added significance. . . . As to the long-range view of this program, Ezra Taft Benson, Secretary of Agriculture, is quoted as saying: "I can visualize thousands of our small watersheds in the condition that God intended them to be: hillsides guarded with a mantle of trees and grass . . . land on the lower slopes and in the valleys protected by other conservation practices that save soil and hold back the water . . . upstream dams, supplementing land treatment, to hold back water when we have too much, and release it when we have too little . . . land in watersheds revitalized; water more plentiful . . . man and nature in harmony!"

Performance features of TORRINGTON CAM FOLLOWERS

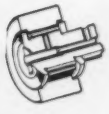
Heavy sectioned outer race to absorb high rolling and shock loads.

Integral stud for cantilever mounting, case-hardened, with tough core for high strength to withstand shock loads.



Easily relubricated at either end or through cross hole in stud. Ends accommodate standard drive grease fittings or plug seals.

Full complement of small diameter rollers for maximum radial capacity and efficient anti-friction performance.



Races precision ground for even load distribution and uniform low end play.

Built to "FOLLOW THROUGH" under high shock loads

Every feature of the Torrington Cam Follower is designed to insure efficient performance and long service life under heavy rolling and shock loads in cam or track follower service.

Precision made throughout, Torrington Cam Followers are available in sizes from ½" to 2¼" OD. Special surface finishes such as chrome and cadmium plate or oxide black can be provided.

Our engineering staff will be glad to work with you in applying these reliable units to your cam-controlled or track-type equipment. You can depend on Torrington Cam Followers to "follow through" on the job because every element is designed for ultimate capacity. *The Torrington Company,* Torrington, Conn.—and South Bend 21, Ind.

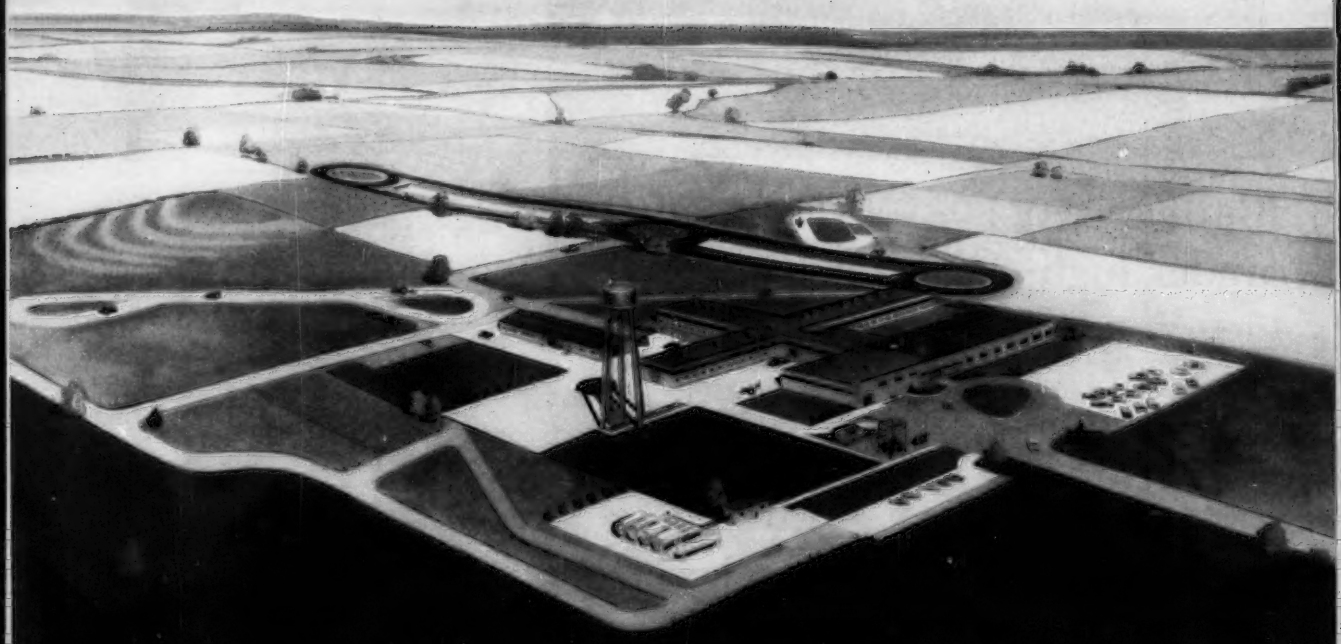
TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • BALL • NEEDLE ROLLERS • THRUST

For more facts circle No. 58 on reply card

John Deere and



This new John Deere Engineering and Research Center *near Waterloo, Iowa provides modern facilities for all phases of tractor research and development work of both the John Deere Waterloo Tractor Works and the John Deere Dubuque Tractor Works.*

Research Engineering Center

Keeps Tractor Quality At Its Highest!

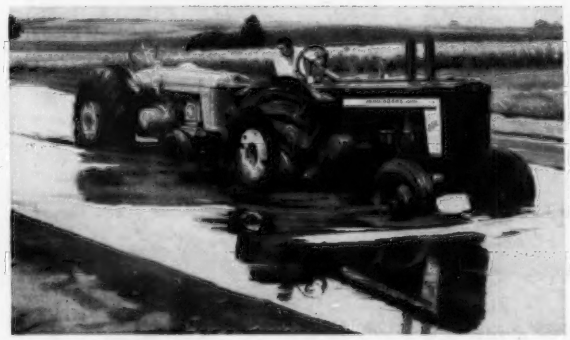
Quality is a precious commodity in any organization, and particularly so in the farm equipment industry. From quality stem the faith and subscription that make one manufacturer's product more acceptable than another's. Tractors are a good example. At John Deere, tractor quality is guarded with a vengeance. The words of the blacksmith, spoken more than a century ago, still ring loud and clear—"I'll never put my name on an implement that hasn't in it the best that is in me."

To this end, a year-'round, never-ending program of research and testing is carried on in this modern John Deere Research and Engineering Center near Waterloo, Iowa. Here, through the media of the test tube and test track, with the aid of modern electronic and mechanical testing devices, the science of agricultural engineering and development pursues the goal of ever-higher tractor quality. The success of this program is evident by the ever-growing number of green-and-yellow tractors that are a familiar part of every rural landscape.

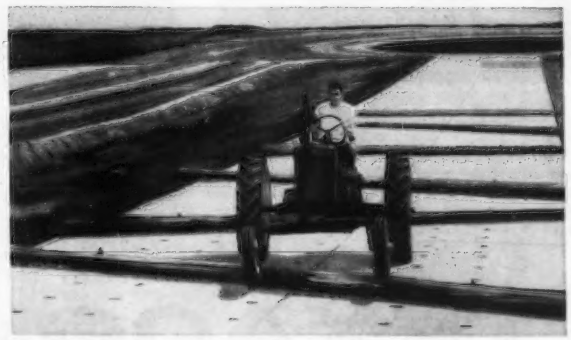
This new center is another example of the modern facilities John Deere provides its engineering staff to insure rapid progress without restriction in the development of ever finer products.

JOHN DEERE
MOLINE, ILL.

..."Wherever Crops Grow, There's a Growing Demand for John Deere Farm Equipment"



***This mud bath,** in which can be mixed varying amounts of sand and clay, enables John Deere engineers to check the effects of weather and abrasives on wheel and axle bearings and oil seals.*



***This obstacle course** subjects the test tractor to punishment far in excess of that encountered in normal field operation. Any weakness in tractor design or construction can be spotted quickly and corrective steps taken immediately.*

FEED & GRAIN HANDLER . . . ONLY $25!

HOURS of back-breaking labor and time are saved with this ingenious grain handler invented by W. C. Eoff, who farms near Hamlin, Texas.

"I built the machine in my farm shop for only $25, from a discarded combine and the front axle of an old car," he says. "It consists of a grain bin, power take-off and unloading augur. I find it invaluable in 'roading' grain from the combine to the barn—also in filling self-feeders."

Mr. Eoff has high praise for Texaco products, including Advanced Custom-Made Havoline Motor Oil that wear-proofs truck and tractor engines for added power and longer engine life. He also likes the dependable, on-time deliveries of Texaco Consignee O. D. Roland.

A MARFAK BOOSTER! Progressive farmer W. N. Aguillard, who farms 736 acres near Jennings, La., insists on Marfak for lubricating his farm machinery. He knows that Marfak is best for bearings that take hard punishment—because Marfak won't wash out, drip out, dry out or cake up. Here he passes the time of day with Texaco Consignee Albert Gauthier.

A 13-YEAR FIRE CHIEF USER! Pete Van Zee, of Lynden, Wash., is shown after receiving an order of Texaco products from Texaco Consignee E. A. Hofman. Mr. Van Zee prefers Texaco Fire Chief gasoline because of its superior fire power for low-cost operation. He buys all Texaco products because he has found it *pays* to use them in tractor, truck and field equipment.

PLAY SAFE with Texaco PT Anti-Freeze. One fill protects the cooling system of your truck, car and tractor all winter. Texaco PT Anti-Freeze won't boil away during warm spells, doesn't foam, guards against rust and corrosion. Here is the top-quality Premium Type anti-freeze at no increase in price. Don't take chances—get Texaco PT *now*.

ON FARM AND HIGHWAY IT PAYS TO USE

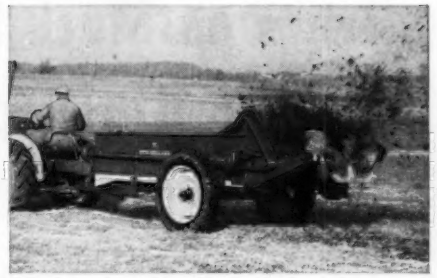
TEXACO Products

DIVISION OFFICES: ATLANTA, Georgia BOSTON 16, Massachusetts BUFFALO 9, New York BUTTE, Montana CHICAGO 4, Illinois DALLAS 2, Texas DENVER 3, Colorado HOUSTON 2, Texas INDIANAPOLIS 1, Indiana LOS ANGELES 15, California MINNEAPOLIS 3, Minnesota NEW ORLEANS 16, Louisiana NEW YORK 17, New York NORFOLK 2, Virginia SEATTLE 1, Washington

Texaco Products are also distributed in Canada, Latin America, and Africa.

TEXACO REG. T.M. THE TEXAS COMPANY

Model 200 SPREADER

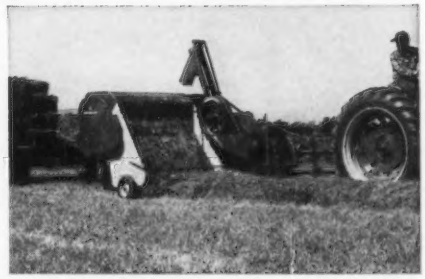


Models 44, 45, 46 MOWERS

For all these "time-rated" grassland

Model 440 CRUSHER with MOWER

Models 68, 77, 87 BALERS



farming implements, New Holland uses

Models 601 and 800 FORAGE HARVESTERS

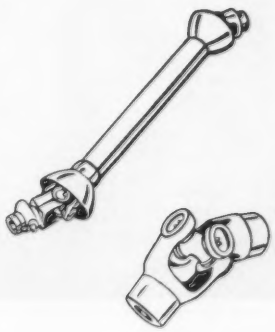
Model 22 FORAGE BLOWER

BLOOD BROTHERS Jointed Drive Lines

"Time-table Performance" with "Time-rated Machinery" offers special advantages. It also means close teamwork with the implements used, so each is ready for action in turn. Each is synchronized to fit into modern high-production farming schedules.

Because every implement must be highly dependable to avoid delays, it's only natural that New Holland uses Blood Brothers Jointed Drive Lines. Thoroughly proved in the field, they deliver long-lasting, trouble-free service on every operation.

Implement builders, dealers and farmer-users know they can count on Blood Brothers Drive Lines. *And that makes any implement easier to sell.* Write or call for further information—we'll gladly assist you.

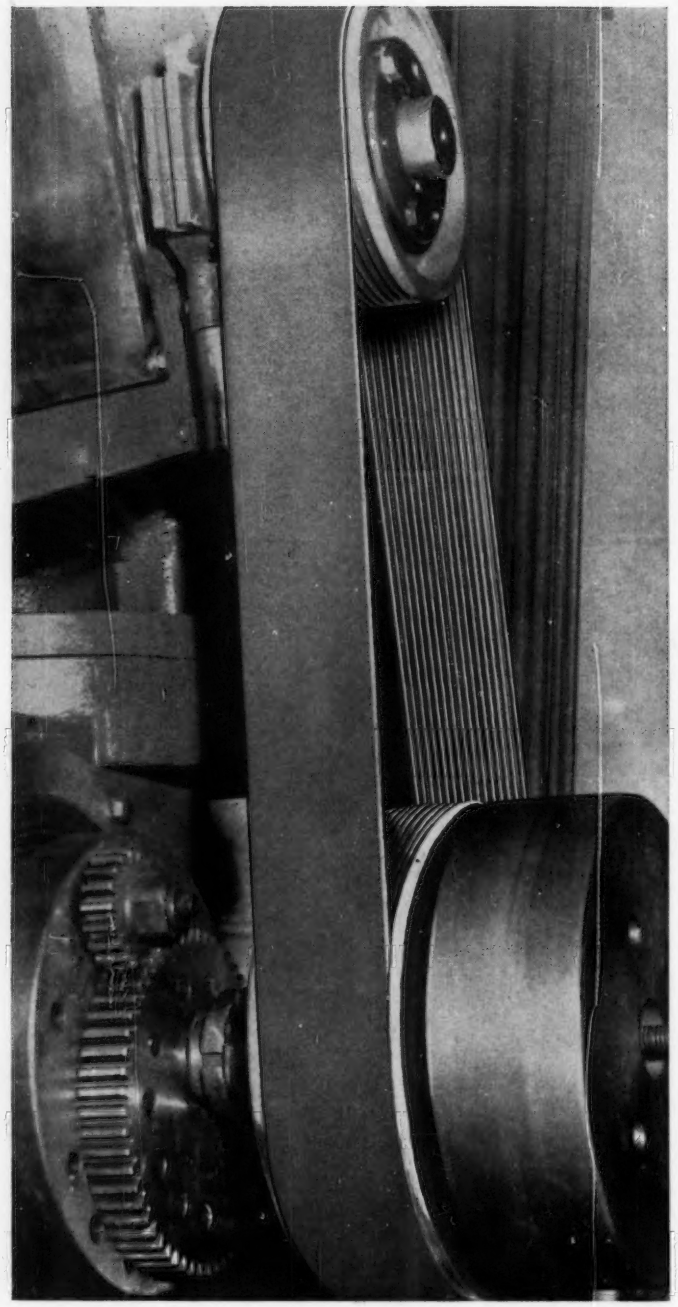


FOR FARM IMPLEMENTS, MORE BLOOD BROTHERS UNIVERSAL JOINTS ARE USED THAN ALL OTHER MAKES COMBINED

BLOOD BROTHERS
MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
ALLEGAN, MICHIGAN

UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

No Other Belt Drive Delivers as Much Power in as Little Space as R/M *Poly-V*® Drive!



Here's the answer to space saving design problems for heavy duty power driven machinery and equipment. Use of R/M's patented Poly-V Drive on this planetary miller almost doubled power capacity of the machine's drive . . . *without* increasing space requirements! Space saving advantages of this new concept in power transmission can improve drive design for a wide range of applications.

Single Unit Design

Poly-V Drive employs a single, endless parallel V-ribbed belt running on sheaves designed to mate precisely with the belt ribs. Single unit design gives Poly-V twice the tractive surface per inch of sheave width . . . to deliver up to 50% *more* power in the same space as a V-belt drive—*equal* power in as little as ⅔ the space! This means *less* shaft overhang, less bearing load . . . a compact, *lighter* drive.

Greater Drive Dependability

Poly-V's single unit design completely eliminates belt matching problems, helps maintain constant pitch diameter and speed ratios from *no* load to *full* load. You get longer drive life, greater drive dependability because drive performance is not limited to individual belt life or efficiency. And—just *two* cross sections of Poly-V Belt meet every heavy duty power transmission requirement!

R/M engineers who developed Poly-V Drive will be glad to assist you in determining the installation that will solve your design problems . . . give you "More Use per Dollar." Contact the R/M representative nearest you . . . or write for Poly-V* Drive Bulletin #6638.

**Poly-V is a registered Raybestos-Manhattan trademark*

RM736

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

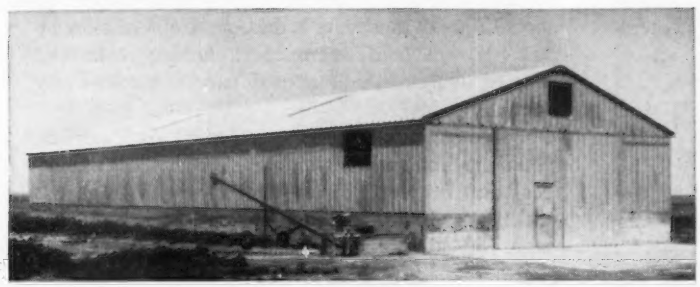
MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

"This tight, good-looking Steel Building is a lasting investment and an asset to my farm,"

says J. D. Hewes, Cimarron, Kansas



"THIS IS THE BUILDING I should have put up years ago," continues Mr. Hewes. "Inside, there's more than enough room for three 14-foot combines, four tractors, three grain drills, trucks and an automobile. Moving equipment about is easy. My Steel Building means added protection and longer life for my farm implements and machinery."

More and more, practical-minded farmers are realizing that for value, low upkeep, fire resistance, and protection against wind, rain, and rodents, Steel Buildings are their best buy. Factory-Built Steel Buildings, fabricated from USS Galvanized Steel Sheets with USS Structural Steel framework, are pre-engineered to take advantage of the strength and durability of steel. For the full story on all the advantages of Factory-Built Steel Buildings, return the attached coupon. There's no obligation, of course.

MODERNIZE NOW FOR A BETTER FARM INCOME. RETURN THIS COUPON

Agricultural Extension
United States Steel Corporation
Room 5637, 525 William Penn Place
Pittsburgh 30, Pa.

I am interested in Steel Buildings for the following:

☐ dairy barns ☐ hay storage ☐ machinery storage
☐ cattle shelters ☐ grain storage ☐ poultry houses

☐ other .....

Approximate size or capacity .....

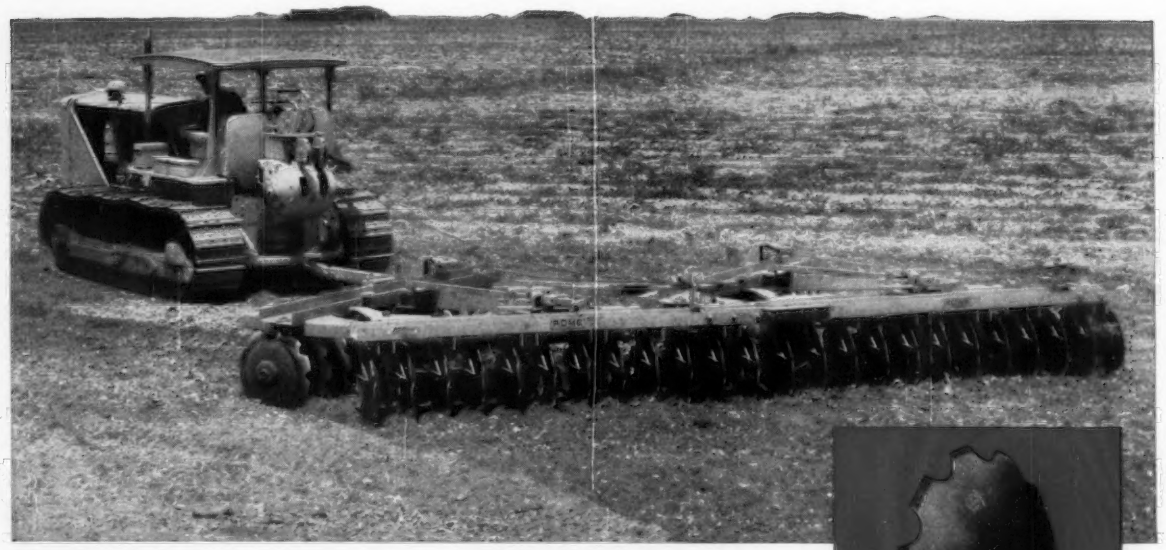
☐ Please have a Steel Building representative call on me with further information. Send information to:

Name .....
Address .....
County .....
Town .....
State .....

United States Steel produces high-quality USS Galvanized Steel Sheets and Structural Steel which our customers manufacture into durable farm buildings. Your request for information will be forwarded to the manufacturers of these buildings, and you will hear directly from them.

UNITED STATES STEEL

Working flinty coral rock soil with a Rome 22' Squadron Harrow equipped with Ingersoll Dura-Notch discs.



Tough jobs go easy with

Ingersoll *Dura-Notch*® Discs

Rome 14-28 equipped with tough Ingersoll discs makes quick work of clearing tangled scrub-growth.

Florida's gritty coral rock soil grows wonderful tomatoes, but it's one of the world's most abrasive on discs. Equally punishing is the rugged job of clearing scrub-growth land where roots, hidden rocks and tangled underbrush shock and jar disc blades every foot of the way.

For tough jobs such as these, Rome Plow Company equips its implements with abrasion-resistant, shock-resistant Ingersoll discs. They churn through the trashiest soil with little sign of wear, because they're made of super-tough TEM-CROSS® steel . . . steel that's *cross-rolled* and specially heat treated to make Ingersoll discs springy, durable and highly resistant to abrasion and impact. No wonder *every* leading implement manufacturer uses Ingersoll discs as original equipment.

Whenever *you* make replacements, always use Ingersoll discs. They're built to make the tough jobs easy. You order them direct from your implement manufacturer.

INGERSOLL PRODUCTS DIVISION
Borg-Warner Corporation, Chicago 43, Illinois

INGERSOLL PRODUCTS B-W BORG-WARNER ®

SPECIALISTS IN TILLAGE STEELS • WORLD'S LARGEST MANUFACTURER OF DISCS
EXPORT SALES: Borg-Warner International, 36 S. Wabash, Chicago 3, Illinois

THE ONLY MANUFACTURER OF DURA-DISC — THE STEEL THAT IS THE ECONOMICAL REPLACEMENT FOR HIGH COST ALLOYS

Agricultural Engineering

November, 1957
Volume 38
Number 11

James Basselman, *Editor*

Engineering Shortage . . .

IN OPPOSITION to a crash program for training engineers and scientists the following statement has been approved by the National Society of Professional Engineers Board of Directors, October 17, 1957:

Within recent weeks, related developments have provided fresh evidence for those who contend that there is a severe shortage of engineering and scientific personnel and, at the same time, for those who maintain that there is not a shortage. This contradictory situation has existed since 1949 when one of the largest engineering graduating classes in history led to predictions of an oversupply — followed a year later by the Korean War, the increase in defense spending and the subsequent high demand for engineering and scientific personnel.

Since then, many leaders in public life and industry have expressed a fear that the output of trained engineering talent has been lacking in numbers to the extent that the nation's security is in jeopardy, and have called for various forms of "crash" programs to produce more engineers. Others have contended during this period that the "shortage" was synthetic, or highly exaggerated.

Recently, defense budget cuts caused the layoff of a number of aircraft employees, including some 1,000 engineers. This resulted in extensive publicity to the effect that the "shortage" was over and that more engineers would be "laid off" as further cuts were made in defense spending. Now, the launching of the Russian earth satellite has resulted in even more extensive statements and publicity that the United States is trailing Russia in scientific achievement because we have not produced enough engineers and scientists compared to the USSR. New demands are being voiced for "crash" programs to train larger numbers of engineers and scientists. Some leading members of Congress have stated that they will move for extensive Federal scholarship programs when the legislators resume their work next January. In the face of this "on-again off-again" situation, the engineering and scientific professions and the general public are understandably confused and uncertain.

The validity of each point of view regarding the supply of engineers depends on interpretation and analysis of data which has been published in great detail and variety. Despite this wealth of information, however, both points of view probably can be defended if the definition of two terms — "engineer" and "shortage" — are made by the respective groups.

The National Society of Professional Engineers has observed and studied the various statements, reports and analyses during this period. We recognize an obligation to the nation's economy, the engineering profession and to the young people who may be considering the choice of an engineering career, to lend assistance in the clarification of these conflicting viewpoints, and to the extent possible to assist in the selection of the best alternatives in the future.

It is most important that the nation not rush into hastily improvised actions having to do with the education of engineers which would only aggravate a complicated and difficult condition that cannot be solved by spur-of-the-moment solutions.

Based on close observation of the engineering profession's growth and intimate experience in professional engineering activities, NSPE believes that the following factors are sound observations for future guidance:

1 Special action to increase today's supply of engineers is not considered necessary or desirable since engineering enrollments are at an all-time high and are continuing to increase.

2 An artificial stimulation to further increase enrollments in engineering will severely handicap institutions that devote adequate attention to the capable students.

3 Assumption that Russia launched the earth satellite before the United States solely because it had trained more scientific personnel in recent years than this country, we believe is not valid and could lead to unwise and damaging decisions. We believe it would be more logical to assume that the controlling factors were priorities assigned to money and emphasis, rather than a shortage of technical personnel in the United States.

4 Emphasis now more than ever should be placed on quality rather than quantity. Potential engineers should be better grounded in fundamentals when they enter the engineering educational program and should be better informed as to the qualifications essential for an individual to become a successful engineer.

5 In view of the present limitations of facilities and faculties, the substantially increased enrollments in our engineering institutions are causing serious difficulties at the present time. Any program which will substantially add to the present number of students must include means to resolve these limiting factors.

6 It should be emphasized that projects such as the earth satellite, guided missiles, etc., depend on highly advanced technology — a mere increase in numbers of those with first degrees will not provide the type of highly advanced technical knowledge which is necessary. It should also be noted that any program based on present needs will not succeed in solving today's technological problems. A program starting today will not produce a single highly qualified engineer or scientist for at least six years.

7 Experience has shown that we have wasted engineering talent by using it at a level below that which it is capable of performing. Improved utilization of engineering talent can do more for an immediate need than any other single program.

Flexible Tubing in Sprinkler Irrigation

Herman Bouwer and J. O. Helms
Assoc. Member ASAE Assoc. Member ASAE

System of moving flexible irrigation tubing shows definite saving in labor. Economics involved depends directly upon useful life of pipe

SPRINKLER irrigation's role in present American agriculture is evident from the several millions of acres that are estimated to be irrigated by this method. The outstanding feature of sprinkler irrigation is the complete control of the amount and the rate of water application, and the partial control of the uniformity of wetting. However, from a materials-handling standpoint (bringing water from where it is to where it is needed), irrigation with portable sprinkler systems usually involves high energy requirements for pumping and high labor requirements for moving pipe.

The energy and labor requirements are the direct results of the principle of water application, which is the distribution of water through the air where break-up, air resistance, and gravity limit coverage. The efficiency of energy utilization for spreading water differs for the various methods of irrigation, and can be expressed in terms of a delivery gradient. This is the energy content of the water at the point of delivery divided by the horizontal distance travelled by the water before infiltration takes place. For a medium pressure sprinkler, the delivery gradient is approximately 350 percent (assuming the distribution pattern of the sprinkler to be triangular). Spacing these sprinklers with overlapping for uniform distribution causes the virtual delivery gradient of the irrigation system to be about 500 percent. This figure compares with delivery gradients of about 1 percent for surface irrigation systems, where the water at the point of delivery needs only to be approximately one foot higher than the field surface. After delivery, the water does its own spreading by means of overland flow in furrows, borders, or other predetermined paths.

The area covered per sprinkler being restricted, the choice of design of a system is between many sprinklers with no moves requiring a high initial investment, and few sprinklers with many moves requiring a large amount of labor. This article deals primarily with the latter alternative because it is used most frequently for field-scale irrigation of agricultural crops.

If only sprinklers were to be moved, the operation of a sprinkler system would not be much of a chore. The necessity of carrying one or more sections of metal pipe with each sprinkler, however, causes the job to be time consuming and strenuous. This is often aggravated by disagreeable working conditions such as high temperature, high humidity, tall crops, wet foliage, and muddy ground. Complete mechanization of moving metal pipe with universal applicability is difficult because the pipe is rigid, the sections have to be coupled and uncoupled manually, and the moving distances are unfavorable. Therefore, the following improvements can be made:

(a) Develop a system whereby sprinklers can be moved without handling rigid pipe and without a dense network of pipe lines.

(b) Develop a lateral that can be moved mechanically regardless of moving distance and crop height.

Objective *(a)* can be obtained by using branched laterals (Fig. 1). The sprinklers are mounted on tripods (Fig. 2) and connected to the lateral with sections of flexible hose. The length of these sections may be equal to or a multiple of the distance between consecutive sprinkler settings. With the branches equal to the distance between settings, three sprinkler settings are obtained for each position of the lateral (Fig. 1). For each move of the lateral, there are two sprinkler moves consisting only of carrying tripods and sprinklers while flexible hose is dragging behind. Quick couplers are used to connect the branches to the lateral (Fig. 2). In case of row crops, a row direction perpendicular to the lateral permits the operator to walk between rows when moving sprinklers.

The second objective *(b)* can be reached by using a flexible lateral that can be wound on a reel, moved to, and

Paper prepared expressly for AGRICULTURAL ENGINEERING. Preliminary report was presented at Southeast Section Meeting, Birmingham, Ala., February, 1957.

The authors—HERMAN BOUWER and J. O. HELMS—are, respectively, associate agricultural engineer and superintendent, agricultural engineering farm unit, Alabama Polytechnic Institute, Auburn.

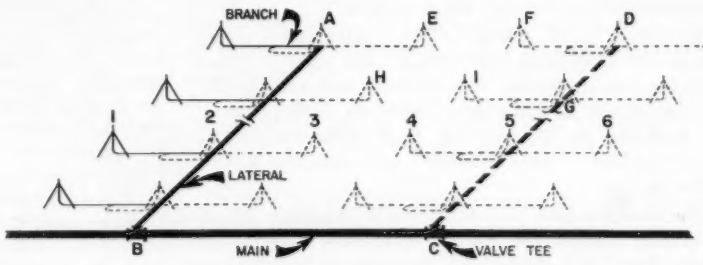


Fig. 1 Example of layout of system with branched laterals. The length of the branches is equal to the distance between successive sprinkler settings

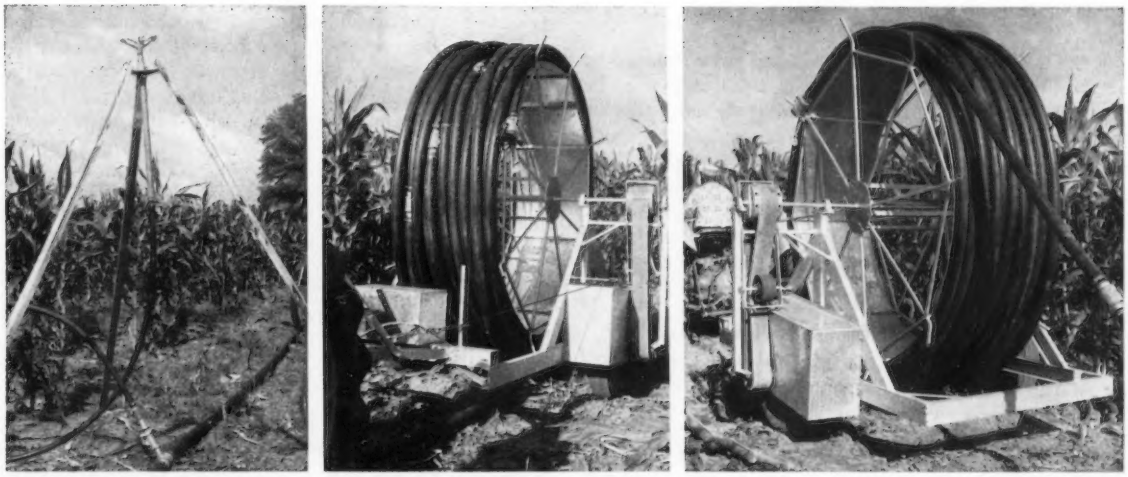


Fig. 2 *(left)* Tripod-mounted sprinkler, and quick-coupler connection between branch and lateral. Position of sprinkler is example of No. 2 in Fig. 1 • Fig. 3 Reel for winding *(center)* and unwinding *(right)* flexible lateral

rolled out at a new position (Fig. 3). In tall crops, alleys are necessary for the laterals so that they can be moved with a tractor and reel.

The two objectives can be applied separately or in combination so as to give the following laterals:

- Flexible laterals with branches (branched flexible laterals).
- Aluminum laterals with branches (branched aluminum laterals).
- Flexible laterals without branches (flexible laterals).

Experimental Systems and Labor Requirements

The labor requirements of irrigation with branched flexible laterals and branched aluminum laterals were compared with a hand-move aluminum lateral in tall drilled corn. The labor requirements with flexible laterals without branches were determined in pasture, since this type of lateral tends to be more applicable to low-growing crops (discussed under subhead, Selection of System). In each case, the sprinklers were spaced 60 ft in the line and 80 ft between lines.

The branches for the systems with branched flexible laterals and branched aluminum laterals consisted of 90-ft sections of 1-in flexible black polyethylene pipe. The same material in a 2-in size was used for the flexible lateral, which was 390 ft long. Galvanized steel tees with 1-in outlets for connecting riser quick-couplers were placed in this lateral at 60-ft intervals. The laterals used in the aluminum-branched-lateral system and in the conventional hand-move system consisted of 20-ft sections of 3-in aluminum pipe.

The reel for moving the flexible lateral had a diameter of 6 ft, and was driven by a pulley mounted on one of the trailer wheels (Fig. 3). Pulley sizes were selected to make the peripheral speed of the winding surface of the reel slightly higher than ground speed. The necessary tension in the lateral and the necessary slippage of the belt while winding or unwinding the pipe were obtained by using a flat belt and a cable-controlled idler arrangement. Tractor speed during coiling and uncoiling was approximately 2 mph. Uneven winding of the pipe was avoided by steer-

Fig. 4 *(Upper left)* Moving tripod and sprinkler to new position, letting flexible tubing drag • Fig. 5 *(Upper right)* Pulling branch through for connecting sprinkler to lateral in new position • Fig. 6 *(Bottom)* Moving flexible lateral. Operator stops to collect quick coupler and to load tripod on rack without leaving tractor

. . . Flexible Tubing

ing the tractor. The riser quick-couplers were removed before rolling the lateral on the reel to avoid damage to the plastic pipe. Since the branches prevented the quick-couplers from working loose, hand-tight fastening of the quick-couplers was sufficient. If the parts of the spokes extending beyond the winding surface of the reel are removable and the reel is detachable, the coil can be slipped off the reel. This may be of advantage for storing the pipe in case of systems with more than one lateral or for using the trailer for other purposes.

Labor Requirements with Branched Flexible Laterals

The initial position of the branched lateral is indicated by solid lines in Fig. 1. The reel was parked at *A* after uncoiling the lateral. The moving operations were performed by one man. Average labor requirements were:

	Man-hours per acre
Closing valve at head of lateral, moving sprinklers from position 1 to 2 (Fig. 4), and reopening valve	0.2
Closing valve at head of lateral, moving sprinklers from position 2 to 3, and reopening valve	0.2
Closing valve at *B*, walking down the lateral, disconnecting branches from lateral, and collecting riser quick-couplers; placing quick-couplers in a box on tractor, bringing tractor and reel in position for rolling in lateral, fastening end of lateral to reel, rolling in lateral from *A* to *B*, disconnecting lateral from main at *B*, moving from *B* to *C*, connecting lateral to main at *C*, rolling out lateral to *D*	0.3
Walking from *D* to *E*, moving sprinkler to *F* while letting plastic hose drag, pulling branch through to *D* (Fig. 5), and connecting branch to lateral with quick-coupler; carrying rest of quick-couplers to *G*, walking to *H*, moving sprinkler to *I*, and connecting branch at *G*; taking rest of quick-couplers, walking up the line, and connecting each sprinkler in order; turning on valve at *C*	0.5
Total number of man-hours for complete cycle of three moves	1.2
Average number of man-hours per acre per irrigation	0.4

Labor Requirements with Branched Aluminum Laterals

The layout of this system was the same as shown in Fig. 1. The flexible lateral moved by a reel was replaced by an aluminum lateral moved by a tractor and trailer. The sprinkler moves were identical to the sprinkler moves with branched flexible laterals. Using one man for moving the sprinklers and two men for moving the aluminum lateral, the labor requirements with this system were:

	Man-hours per acre
Moving sprinklers from position 1 to 2	0.2
Moving sprinklers from position 2 to 3	0.2
Moving sprinklers from position 3 to 4	0.5
Loading aluminum pipe on trailer, moving 240 ft, and laying out pipe at new position	0.9
Total number of man-hours for complete cycle of three moves	1.8
Average number of man-hours per acre per irrigation	0.6

Labor Requirements with Flexible Laterals

No branches were used in this system. The tripods were set up over the flexible lateral, which was moved by the reel for every sprinkler move. Short sections of plastic hose were used to connect the sprinklers to the lateral (Fig. 6). Tripods with sprinklers and plastic hose were loaded and moved on a rack constructed over the hood of the tractor. Offsetting the tripods a few feet from the lateral enabled the operator to load the tripods without leaving the tractor (Fig. 6). With one man doing the job, labor requirements were:

	Man-hours per acre per irrigation
Closing valve at head of lateral, walking down the line, disconnecting, removing and placing quick-couplers on top of tripod; rolling in lateral while stopping every 60 ft to collect quick-couplers (Fig. 6) and to load tripods; rolling out lateral at new position while throwing off a tripod and quick-coupler every 60 ft, parking reel at end of line, walking back, setting up tripods and connecting plastic hose to lateral, and turning on valve	0.7

The labor requirements of moving aluminum laterals by hand in tall drilled corn were 1.0 man-hours per acre per irrigation, using one man per lateral. The lateral was placed at a right angle to the row direction. The pattern of alleys in the crop was the same as in the branched-lateral layouts, i.e. at distances of 240 ft.

In addition to the number of man-hours, the amount of human energy required for operating a sprinkler system is important. Flexible laterals and branched flexible laterals completely eliminated the need for handling metal lateral pipe (moving a 3-in aluminum lateral by hand required carrying of about 350 lb of pipe a distance of 80 ft per acre per irrigation). With branched aluminum laterals, manual handling of lateral pipe was limited to uncoupling, loading on and unloading from a trailer, and coupling the pipe sections. Calculated walking distances required for operating the different systems in tall row crops are presented in Table 1.

TABLE 1. CALCULATED WALKING DISTANCES FOR OPERATING DIFFERENT SPRINKLER SYSTEMS

(Figures are based on a sprinkler spacing of 60 x 80 ft and a 510-ft lateral, which covers one acre per setting)

	Walking distance in man-ft per acre per irrigation
Hand-move lateral (one man)	
20-ft sections of pipe	6,200
30-ft sections of pipe	4,760
Branched flexible lateral (one man), average per cycle of three moves	2,940
Branched aluminum lateral (one man for moving sprinklers, two men for moving lateral), average per cycle of three moves	3,790
Flexible lateral (one man)	1,020

Design of Branched Flexible Laterals

Practical application of flexible tubing in sprinkler irrigation may be limited to the use of smaller pipe sizes because of such factors as weight, cost, allowable pressures, and flexibility. With branched laterals, however, it is technically possible to offset excessive pressure variations in the lateral by proper selection of pipe sizes for the branches. This enables use of smaller pipe diameters for branched laterals than for laterals with the sprinklers directly mounted on the line. In case of aluminum branched laterals, a choice can be made between a conventional design and a design for use of smaller pipe diameters with equalization of sprinkler pressures by controlled friction losses in the branches. The latter is essentially a trial and error procedure, since sprin-

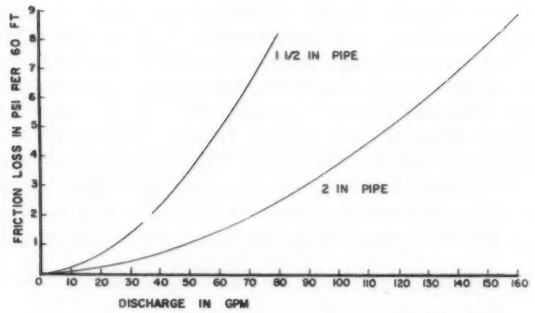


Fig. 7 Friction loss in 1½ and 2-in polyethylene tubing (based on chart by Southwestern Plastic Pipe Co.)

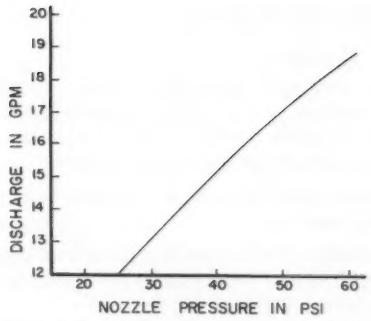


Fig. 8 Discharge as a function of pressure for a sprinkler with 7/32 in x 3/16 in nozzles (based on table in Rainbird catalog for sprinkler No. 70B)

kler pressures, discharges, and pipe sizes are interrelated and initially unknown. In the solution of the problem, the hydraulics of the branched lateral is calculated for several carefully selected assumed starting values. The desired operating conditions are then determined by interpolation. This procedure is illustrated by the following example.

Problem:

To design a branched flexible lateral using black polyethylene tubing with a maximum working pressure of 65 psi. The maximum difference between pressures at the sprinklers is 20 percent of the average sprinkler pressure of 40 psi. The sprinkler spacing is 60 x 80 ft, the desired application rate 0.3 in per hr, and the length of the lateral 510 ft.

Solution:

The following information is used in the solution of the problem:

1 A graph showing the relation between friction loss and discharge per 60-ft pipe for the sizes that may be suitable for the lateral (Fig. 7).

2 A graph showing the relation between discharge and pressure for the sprinkler selected (Fig. 8).

3 A graph showing the relation between the pressure at the beginning and at the end of the branch for different pipe sizes and for the sprinkler selected (Fig. 9). This graph is constructed by assuming a number of sprinkler discharges. The friction losses in the branches for these discharges are determined by appropriate tables or formulas. These losses are then added to the corresponding sprinkler pressures as obtained from Fig. 8 to give the pressures at the beginning of the branch.

Discharges and pressures in the branched lateral are calculated for several assumed pressures at the last sprinkler. The computation starts at the end of the line and progresses in an upstream direction. Proper pipe sizes for an approximately uniform sprinkler performance are selected during the process of calculation. Because of low discharges at the end of the lateral, 1½-in pipe is used for the final 180 ft. The calculation proceeds as follows (Fig. 10).

	psi	gpm
Assumed pressure at sprinkler No. 9	38.0	
Pressure at beginning of branch No. 9 (from Fig. 9)	42.5	
Discharge in section 8-9 of lateral (from Fig. 8)		14.8
Friction loss in section 8-9 of lateral (from Fig. 7)	0.5	
Pressure at beginning of branch No. 8 (sum of pressure at beginning of branch No. 9 and friction loss in section 8-9 of lateral)	43.0	
Pressure at end of branch No. 8 (from Fig. 9)	38.5	
Discharge from sprinkler No. 8 (from Fig. 8)		14.9
Discharge in section 7-8 of lateral (sum of discharge in section 8-9 of lateral and discharge from sprinkler No. 8)		29.7
Friction loss in section 7-8 of lateral (from Fig. 7)	1.4	
Pressure at beginning of branch No. 7	44.4	

This process is continued until the head of the lateral is reached (pressure recovery caused by velocity reduction and friction losses in fittings and bends is neglected). The results of the completed calculation (Fig. 10) give an average sprinkler pressure of 41.6 psi. A second trial with an assumed pressure at sprinkler No. 9 of 35 psi resulted in an average pressure of 38.1 psi. Interpolation gives a value of 36.6 psi for the desired pressure at sprinkler No. 9. Calculation of pressures and discharges at this value shows that the design requirements are practically obtained (Fig. 10). The average sprinkler pressure is 39.9 psi, the maximum difference between sprinkler pressures is 7.9 psi or 19.7 percent of the average sprinkler pressure, and the pressure at the beginning of the lateral is 0.2 psi below the maximum working pressure of 65 psi.

In practice, the trial and error procedure with interpolation for designing branched laterals may not be necessary. Since flow velocities in the tubing and in the jet as it leaves the nozzle of the sprinkler both vary with pressure head raised to a power equal or close to 0.5, the pressure ratios in the branched lateral remain relatively unaffected by the actual level of the operating pressures. Therefore, the desired operating conditions for the branched lateral may be obtained after one trial by a process of linear adjustment of the pressures and square-root adjustment of the discharges.

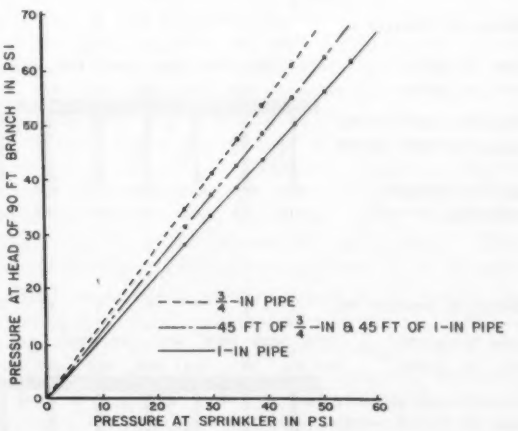


Fig. 9 Relation between pressure at beginning of branch and at end of branch for several pipe sizes and sprinkler of Fig. 8 (based on table by Southwestern Plastic Pipe Co. and Fig. 8)

. . . Flexible Tubing

Selection of System

Where application of flexible tubing is technically possible, the selection of equipping a sprinkler system with conventional, branched flexible, branched aluminum, or flexible laterals depends on the following factors.

- Yearly operating cost as determined by fixed and operational cost.
- Possibility of difference in returns from irrigation due to influence of human effort for operating system on utilization of irrigation system.
- Effect of type of lateral on human energy requirements for moving sprinklers.

Limited experience with flexible tubing makes estimating depreciation periods difficult. It is possible, however, to estimate the number of years (symbol N) that the flexible tubing must last for equal net profit from irrigation as compared with conventional laterals. Because of the great variety of conditions and the many factors involved, each case constitutes an individual problem and must be considered as such. For this reason, the discussion of economic aspects is limited to a simplified analysis for a hypothetical case.

The effects of the type lateral on the degree of utilization of the irrigation system and the resulting returns from irrigation are difficult to express in concrete values. The same is true for the effect of the type lateral on the human energy requirements. Consequently, the selection of the system is at least in part governed by personal views of the irrigator. Utilization of equipment and human energy requirements are factors that tend to weigh more heavily where suitable labor for operating sprinkler systems is difficult to obtain.

The economic analysis is limited to conventional, branched flexible, and branched aluminum laterals. These laterals are of a more universal applicability than flexible laterals, which need to be moved with every sprinkler move. This moving requires room at each sprinkler setting for the tractor and reel, which may be objectionable in tall crops where alleys cause losses of irrigated crop land. The lateral without branches is also handled more frequently than branched laterals, which may adversely affect the useful life of the flexible tubing. Absence of branches also limits the use of smaller pipe sizes for the lateral, since excessive pressure variations cannot be as easily offset as by controlling friction losses in the branches. Traction problems on irrigated land may be more serious with flexible laterals than with branched flexible laterals, since the latter afford drainage of the soil near the lateral for a period at least equal to one sprinkler setting before the lateral needs to be moved.

The analysis applies to the following conditions:

Shape of field	rectangular
Size of field	64 acres
Dimensions of field	1,080 x 2,580 ft
Main line	2,510 ft of 6-in pipe in center of field
Laterals	4 laterals of 510 ft each, symmetrically arranged on main
Sprinkler spacing	60 x 80 ft
Application rate	0.3 in per hour
Amount per application	2 in
Number of sprinkler moves	2 per day
Static lift	23 ft
Distance to water source	50 ft from edge of field

The conditions in this case, i.e. low application rate, medium pressure sprinklers, long main, and laterals of limited length are favorable for use of flexible tubing.

Major cost figures for a conventional system and a branched-flexible-lateral system for this field are shown in Table 2, which excludes items that both systems have in common. A depreciation period of 15 years is used for all equipment other than the flexible tubing which in this case is black polyethylene pipe. The number of man-hours employed in the calculation of labor costs are those observed at the API agricultural engineering farm unit in tall corn, and mentioned under "Experimental Systems and Labor Requirements." Equating the total yearly cost figures for each system gives for N a value of 9.6 years. Counting labor at $1.50 per hour instead of $1.00 per hour reduces N from 9.6 to 6.8 years.

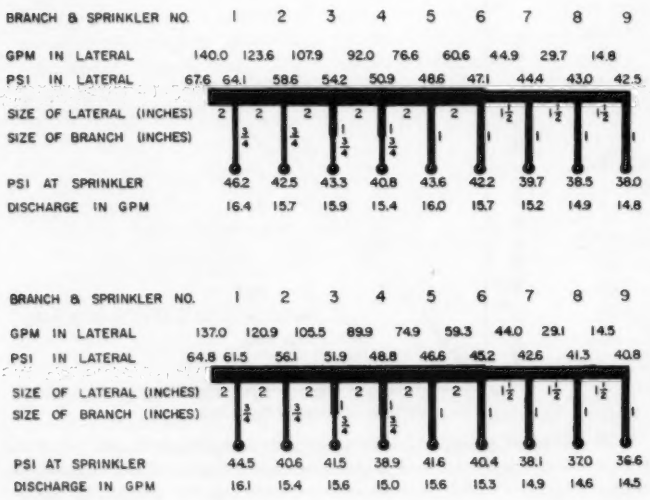


Fig. 10 First trial *(above)* and final solution *(below)* of hydraulics of branched flexible lateral

TABLE 2. APPROXIMATE COST FIGURES FOR CONVENTIONAL AND BRANCHED-FLEXIBLE-LATERAL SYSTEMS
(based on estimated and list prices)

	Initial cost, dollars	Cost per year, dollars
CONVENTIONAL SYSTEM WITH ALUMINUM LATERALS		
2,040 ft of 3-in aluminum pipe with couplers, riser quick-couplers and 6-ft riser pipes	1,850	123
32 6-in control valves at $35 per valve	1,120	75
Pump and power unit (Diesel, 548 gpm at 155 ft)	3,500	233
Fuel cost (5 irrigations or 560 pump-hours per year, 2.2 gal per hour at 15c per gal)		185
Labor cost (5 irrigations of 64 acres, 1.0 man-hours per acre per irrigation at $1 per hour)		320
TOTAL PER YEAR		936
SYSTEM WITH BRANCHED FLEXIBLE LATERALS		
Polyethylene pipe, adapters, fittings, quick-couplers, and tripods for 4 laterals as in Fig. 10	2,300	2,300/N*
11 6-in control valves at $35 per valve	385	26
Trailer and reel for moving lateral	300	20
Pump and power unit (Diesel, 548 gpm at 200 ft)	4,300	287
Fuel cost (5 irrigations or 560 pump-hours per year, 2.8 gal per hour at 15c per gal)		235
Labor cost (5 irrigations of 64 acres, 0.4 man-hours per acre per irrigation at $1 per hour, neglecting cost of using tractor)		128
TOTAL PER YEAR		2,300/N+696

*N is equal to minimum number of years of useful service necessary for equal net profit from irrigation.

Increased utilization of an irrigation system may affect the economic aspects in one or both of the following respects: *(a)* greater capacity of the system by increasing the number of moves per day but keeping the irrigation frequency the same, *(b)* higher level of irrigation by reducing the irrigation frequency.

Greater capacity of the system and higher level of irrigation both result in more pump-hours and normally in increased total returns. If for instance 5 irrigations are necessary for optimum crop production, and this number can be applied with branched flexible laterals, but only 3 irrigations are possible with a conventional system, and assuming that the corresponding difference in financial returns is $20 per acre per year, N would be reduced from 6.8 to 1.7 years for the example in question.

The labor requirements in this economic comparison were determined on firm soil. Moving sprinklers on soils that are muddy after irrigation will probably require more time. The walking distance per irrigation is largest for the conventional system (Table 1). Therefore, adverse soil conditions will tend to affect the labor requirements for moving aluminum laterals to a greater degree. Consequently, N will be less where walking speeds are limited by the condition of the soil after irrigation.

The cost of equipping the aluminum laterals in Table 2 with 90-ft branches of 1-in black polyethylene tubing is estimated at $720 for the 36 sprinklers, including tripods and fittings. The friction losses in the branches are about 4.5 psi, or 6.7 percent, of the total dynamic head for the conventional system. Since this will probably not require a larger pump and power unit, there is only an increase in pumping costs due to increased fuel consumption. This amounts to about $2.50 per irrigation for the 64 acres.

Where an existing conventional system is converted into a branched-aluminum-lateral system, there is no reduction in the number of control valves to help offset the cost of the branches. In that case, the number of irrigations in which the reduction in labor requirements pays for the branches (labor at $1 per hour) is computed as

$$720/[64\times1\times(1.0-0.6)-2.50]=31 \text{ irrigations.}$$

Plastic branches have been used successfully at the API agricultural engineering farm unit since the beginning of 1956.

In case of a new branched-aluminum-lateral system, there is a saving of 21 main-line control valves, which at an estimated cost of $35 per valve, entirely offsets the cost of the branches for this example.

Summary

Flexible tubing was used in an experimental sprinkler system in the form of branched flexible laterals, branched aluminum laterals, and flexible laterals. The labor requirements with branched flexible and branched aluminum laterals for irrigation of tall corn were 0.4 and 0.6 man-hours per acre per irrigation, respectively, as compared with 1.0 man-hours with a hand-move aluminum lateral. Flexible laterals required a moving time of 0.7 man-hours per acre per irrigation in pasture. Use of flexible tubing also eliminated the need for carrying metal lateral pipe, and reduced the walking distance for moving sprinklers.

Smaller pipe sizes can be employed for laterals equipped with branches, since excessive pressure variations in the lateral can be offset by controlled friction losses in the branches. The design procedure for branched laterals is discussed and illustrated with an example.

An economic analysis for a hypothetical case with black polyethylene pipe as flexible tubing shows that the estimated useful life of the branched flexible lateral necessary for equal net profit as compared with a conventional system must be 2 to 10 years, depending on cost of labor and equipment utilization. Cost estimates for a branched-aluminum-lateral system for the same case shows that the cost of the branches was entirely offset by the saving in control valves. Because of difficulty in assigning concrete values to the effect of use of flexible tubing on the utilization of the system and on the human energy requirements for operating the system, the selection of using flexible tubing must be partially guided by personal views of the irrigator.

Black polyethylene tubing was used in an experimental system to determine principles of operation and labor requirements. In selecting or developing flexible tubing for use in sprinkler irrigation, working pressure, durability, available sizes, flexibility, weight, and cost are factors to be considered. The results with the experimental systems indicate, however, that suitable flexible tubing may serve as a tool for improving the labor aspects of irrigation with portable sprinkler systems.

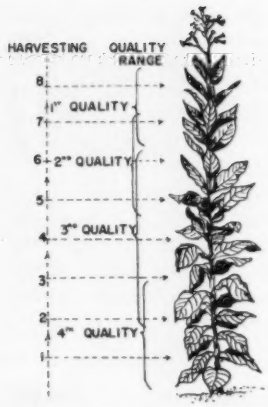


Fig. 1 Sketch of aromatic tobacco plant with order of harvesting and quality range

Harvesting and Curing Aromatic Tobacco

Robert L. Shaw

Vernon H. Baker
Member ASAE

McNeil Marshall
Member ASAE

Harvesting and curing processes, as well as labor requirements and return per acre, are presented for a relatively new but important crop in American agriculture

FOR more than 35 years aromatic tobaccos have been blended with domestically grown tobacco in the manufacture of American cigarettes. Aromatic tobacco is largely responsible for the added flavor and aroma in most popular brands of blended cigarettes. At present, the manufacturers of these cigarettes use more than 80 million pounds of aromatic tobacco per year, most of which is being imported from Turkey and Greece. Less than 1 percent of this demand is now being produced in the United States.

Aromatic tobacco, often referred to as Turkish tobacco (Fig. 1) was first grown in this country at Duke University in 1939 on an experimental basis. Since that time limited research has been in progress at the Virginia, North Carolina, and South Carolina Agricultural Experiment Stations (1, 2, 3).* Increased interest in the crop in recent years has stepped up research activity in Virginia and in South Carolina. In 1950 field tests on curing aromatic tobacco were started in Virginia (4, 5), and laboratory studies were started in 1956 (6).

This article presents pertinent information on some of the requirements for producing the crop, particularly as related to harvesting and curing.

Paper presented at a meeting of the Southeast Section of ASAE, Birmingham, Ala., February 1957.

The authors—ROBERT L. SHAW, VERNON H. BAKER and MCNEIL MARSHALL—are, respectively, tobacco specialist, agronomy dept.; professor; and associate professor, agricultural engineering dept., Virginia Polytechnic Institute, Blacksburg.

Acknowledgments: The authors wish to acknowledge the cooperation of the U.S. Department of Agriculture and the Appalachian Electric Power Co. for assistance in the experimental barn curing test.

*Numbers in parentheses refer to the appended references.

The major operations in farm processing of aromatic tobacco are shown in Fig. 2. These operations in the order in which they are performed are: *(a)* Harvesting leaves. *(b)* Wilting, yellowing and curing. *(c)* Bulking and baling. *(d)* Storage and marketing.

Labor Requirements

Aromatic tobacco is a relatively small plant, and the largest leaves are only about the size of a man's hand. Sixty to seventy thousand plants are grown on one acre of land, and approximately 36 leaves are harvested from each plant during six or seven primings. At the present time the production of aromatic tobacco involves the use of hand labor primarily. Mechanical transplanters that can be slowed down to allow the necessary rate of planting are being used successfully in setting the plants. Handsetting an acre of aromatic tobacco requires about 210 man-hours of labor, whereas a mechanical transplanter requires only 95 man-hours. The labor required in each month during the growing, harvesting, and curing seasons is shown in Fig. 3, (4). The peak occurs in July and August, the harvesting and curing season.

Approximately 200 man-hours of labor are required to grow an acre of aromatic tobacco to harvesting stage. The major operations of harvesting and processing, including marketing, consume a little over 400 man-hours as shown in Fig. 2. A typical, well-managed acre of aromatic tobacco produced by an experienced grower requires a total of approximately 614 man-hours of labor. Without the use of the mechanical transplanter the total would be about 730 man-hours. Compared to the labor required to produce flue-cured tobacco, it is noted that on 120 farms (7) in southern Virginia and northern North Carolina in 1949 that 596 man-hours of labor were required per acre of flue-cured tobacco

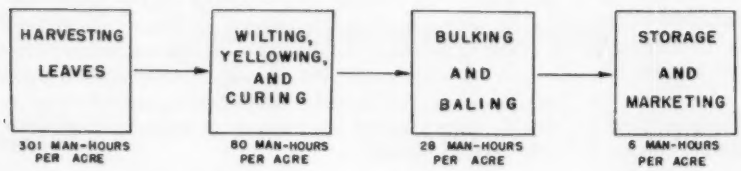


Fig. 2 Major operations in farm processing of aromatic tobacco with approximate man-hours to accomplish each operation

Fig. 4a *(Left)* Placing leaves on wires in preparation for curing. • Fig. 4b *(Right)* Leaves on wilting rack in wilting shed

with the use of mechanical transplanters. In eastern North Carolina in 1952 man-hours of labor required to produce one acre of flue-cured tobacco were 482 (8), and by 1956 in the same area this figure had been cut to 389 man-hours. New techniques and developments through research and experience can certainly be counted on to reduce the labor requirements for producing the aromatic tobacco crop in future years.

Harvesting the Leaves

Aromatic tobacco is harvested by priming the mature leaves from the plant as they ripen. Priming is the removing of all mature leaves from the plants in the entire field at one time. When the leaves are ready to be primed they are still green with a greenish yellow tint. When maximum yield and quality are to be realized it is of utmost importance that aromatic tobacco leaves be harvested at the proper time.

Approximately six leaves are removed from a tobacco plant at each priming. Primings occur successively 5 to 8 days apart. Primed leaves are kept in the hands, with stems aligned, and are placed on 27-in long wires by piercing a handful at a time. Up to 100 leaves (Fig. 4A), depending on size, are placed on the No. 10 galvanized wires which are designed to fit into racks, or frames. The loaded wires are removed from the fields as the racks are filled, and are taken to the wilting shed (Fig. 4B).

Because of the great number of plants per acre and more leaves per plant, it takes longer to harvest aromatic tobacco than it does other types (Fig. 5).

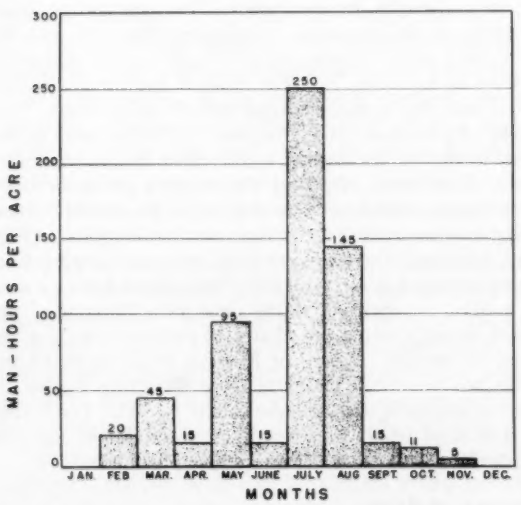


Fig. 3 Labor distribution by months on one acre of aromatic tobacco. Shows 95 man-hours required to transplant one acre with mechanical transplanter in May

Wilting

Wilting begins when the aromatic tobacco leaf is removed from the plant. It should be allowed to take place in a relatively cool, shaded area where air is free to move through the tobacco leaves. Before the tobacco is placed in the wilting shed the loaded wires need to be spaced in the racks so the leaves do not overlap those on adjacent wires or racks. During this wilting period, usually lasting 36 to 72 hr, the tobacco loses about three-fourths of the water that was in it when placed in the shed, and the leaves change from green to yellow. Relative humidity of 60 to 80 percent in the wilting area appears to be optimum, although quite difficult to maintain. Two inches of sawdust on the floor of the wilting shed, wetted down as required, is helpful in keeping the humidity up in dry weather. Extended periods of wet weather, and high relative humidity require spacing the tobacco farther apart for greater air circulation. During wilting the tobacco leaves should be examined frequently. Should water in any form appear on the surface of the leaves the tobacco should be moved immediately into the barn and curing begun.

Curing

Early curing procedures in this country were patterned after those used in Turkey, where the tobacco was strung on strings, fastened to sticks, and cured in the sunshine. Because of different climatic conditions here it was necessary to provide racks so the tobacco could be moved under shelter at night, or when the weather was unfavorable for curing out of doors. Even so, extended periods of damp,

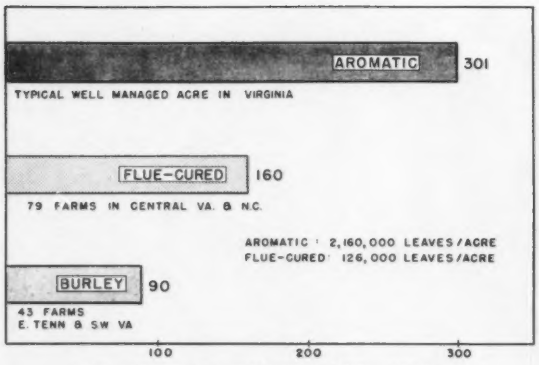


Fig. 5 Approximate number of man-hours required to harvest aromatic tobacco by hand as compared with hand harvesting other types of tobacco

rainy weather slow down the curing of the tobacco, and often cause severe damage to one or more curings each season. These experiences have led to the use of supplemental heat in the curing of aromatic tobacco.

After the wilting process has taken place the tobacco is put in a special barn to finish curing. This usually takes 6 to 8 days, depending on the curing facilities and the weather conditions during the curing period. Aromatic tobacco barns are designed to hold one priming of tobacco. Usually by the time one priming has cured, another is ready to be put in the curing barn. The use of thermostatically controlled heat helps to shorten the curing time by making a continuous process, and insures against leaf damage in the curing barn.

The curing barn for aromatic tobacco need not be an expensive building. It should be of such size as to accommodate the grower's crop (10). Often some existing structure on the farm can be made suitable for use as a curing barn. Present methods of curing make use of heat and forced-air circulation, so it is necessary that the curing space be reasonably tight, and that doors and ventilators fit well when closed.

The most generally accepted aromatic tobacco curing system in this country includes the use of an oil-burning, forced warm-air furnace. Heated air is forced in at the top of the curing barn and travels downward through the tobacco to metered air outlets around the bottom of the barn (10, 11). Temperature inside the curing barn may not exceed 100 F without damage to the tobacco being cured. When this system is used there is about one complete air change per minute in the curing barn.

Fig. 6 Experimental curing barn using forced ventilation and electric strip heaters for supplemental heat

Aromatic tobacco has been cured in an experimental barn successfully for the last 5 or 6 years (Fig. 6), using forced air at the rate of 2 air changes per minute, plus only a relatively small amount of supplemental heat (5, 12). The curing barn was built tight, insulated, and designed for recirculation of the heated air. It had a false floor, with metering cracks designed to provide uniform distribution of air from the plenum chamber underneath. A 24-in propeller fan was used for moving approximately 6000 cfm of air into the plenum. Two electric heating elements, totaling 5,000 watts capacity, were placed in front of the fan to provide the supplemental heat.

Bulking Down Before Baling

When the tobacco in the barn has cured properly the leaves should be dry enough to rattle when handled but not so dry that they will crumble, or break to pieces. The wires of tobacco should be removed from the curing racks keeping the different primings separated. The day before the tobacco is to be baled the wires of tobacco should be bulked down. This is done on a dry floor or platform where air is free to pass around the bulk. The wires and leaves are kept straight in layers so that the completed bulk will be 2 to 3 ft high. The pile of tobacco is covered with something like cotton sheeting and then boards are placed on top to press it down with 10 to 15 lb of weight.

Baling

Aromatic tobacco is packed into special bales that weigh from 20 to 25 lb, as shown in Fig. 7. These are temporary packages, marked to show priming, that are convenient to handle by the grower as well as the buyer. The bales provide some protection to the tobacco from excessive moisture gain or loss, and from physical damage. Aromatic tobacco handles well and can be baled properly when the wet basis moisture content is between 12 and 18 percent. The leaves crumble if the moisture content is below 12 percent, and the baled tobacco is likely to mold if moisture content is above 18 percent wet basis (6).

In order to properly bale aromatic tobacco it is necessary to use a specially designed press. The press can be made of plywood, and consists of a rectangular box 12 in wide by 28 in long and 20 in high, inside dimensions, and without a bottom or top (Fig. 7). The press is used on a separate wood base that is slightly larger than its own bottom. The cover, or press board, used to press the tobacco down in the box, should be just slightly smaller than the inside dimensions of the press. Necessary also, to get a good solid bale, is an extension sideboard to add height to the press and allow space for compressing the tobacco to the bale box size (Fig. 7). A burlap liner, made especially to cover this type of tobacco, is placed in the press box. The tobacco leaves, a wire at a time, are then put in the press with the ends of the leaves lapped about one-third and the stems just touching the sides of the box. When the bale has been completed the press box is carefully removed at the same time the burlap liner is pulled tight around the bale of tobacco. The burlap is then laced from top to bottom on the sides and one end of the bale so that it will remain tightly packed.

Storage of Bales

The baled tobacco should be placed in a clean, dry building that has a wooden floor well above ground level. They

Fig. 7a *(Left)* Press for forming bale of tobacco. • Fig. 7b *(Right)* Bale of aromatic tobacco ready for market

should be laid flat on the floor and turned over each day until the bottom side feels as dry as the top side. When they can be stacked three deep and turned every 3 or 4 days. Changing positions of the bales should be continued in this manner until the tobacco is marketed. Every time the bales of tobacco are turned a check should be made for any sign of molding between the bales, or in the bales. Preliminary laboratory tests indicate that aromatic tobacco in bales may mold at temperatures of 60 to 80 F when the relative humidity remains high (6).

Aromatic tobacco is sold in community centers in the areas where it is grown. Representatives of the buying company grade each bale, tagged as to the priming, in the presence of the grower. The price per pound paid to the grower for his tobacco is in accordance with contract prices per specified grade provided the farmer before the crop was grown.

Returns Per Acre

Cash returns from aromatic tobacco depend on growing conditions, insect and disease infestations, and the attention given to the growing of the crop. An experienced grower, following recommended practices, could produce up to 1,000 to 1,200 lb of aromatic tobacco on one acre of suitable soil during an average growing season. In this enterprise he would expend from 600 to 700 man-hours of labor, which would include all light work performed by women and children. Properly cured and cared for until marketing time, the tobacco would average from 90¢ to $1.00 per pound when sold. The return per acre over direct cash outlay would be about $1,000.00. The estimated return per hour of labor performed, cash expenses deducted, would amount to about $1.50 (4) where 730 man-hours (hand setting) were required to produce the crop. With the use of mechanical transplanters the estimated return would be $1.90 per hour of labor expended. This return per acre compares favorably with estimated returns over direct cash outlay of $1.70 per hour of labor for flue-cured tobacco where partial mechanization is used (8).

Summary

Aromatic tobacco, equal in quality to that imported, can be produced in the southeastern United States on mountainous and Piedmont type soils. A description of a harvesting and curing process, labor requirements and returns per acre were presented. Since production controls on aromatic tobacco can not be justified in the forseeable future, it will be an interesting new crop to watch.

References

1 Spasoff, Luben. Progress report on Turkish tobacco investigations, Virginia Agricultural Experiment Station, Chatham, Va. (unpublished) 1941-42.

2 Darkis, F. R. and Mattison, Robert. Aromatic tobacco, instruction for its production in Southeastern United States. Duke University Tobacco Bull. 1. March, 1947.

3 Mattison, J. R. and Martin, J. A., and Senn, T. L. Aromatic tobacco, instruction for its production in South Carolina. Extension Bull. 111. Clemson Agricultural College. June, 1953.

4 Shaw, R. L. Progress report aromatic tobacco production. V.P.I., Blacksburg, Va. (unpublished) 1953.

5 Marshall, McNeil. Progress report on aromatic curing barn tests. Agricultural engineering department, V.P.I., Blacksburg, Va. (unpublished) 1953.

6 Baker, V. H. Laboratory curing test on aromatic tobacco progress report. Agricultural engineering department, V.P.I., Blacksburg, Va. (unpublished) 1956.

7 Crop production practices, Bull. FM-92, USDA Bureau of Agricultural Economics, Washington, D. C., May, 1953.

8 Cost of producing farm crops, N. C. State College Bull. 29, Raleigh, March, 1952.

9 Cost of producing farm crop in North Carolina, Bull. 52, Agricultural Experiment Station, Raleigh, December, 1956.

10 Marshall, McNeil. Plan for aromatic tobacco curing barn, Plan No. 1-350. Agricultural engineering department, V.P.I., Blacksburg, Va., 1952.

11 Matthews, G. R. and Shaw, R. L. Aromatic tobacco production in Virginia. V.P.I. Extension Bull. 204, Blacksburg, April, 1956.

12 Koontz, L. L. New crop plus better curing yields more profits, *Electricity-on-the-Farm,* January, 1951.

Individual Spring-Release Beams for Moldboard Plows

Richard T. Brown
Member ASAE

The author presents a problem pertinent to mounted and semimounted equipment, and offers a practical solution as a guide toward still further improvement

DAMAGE of earth-working tools by impact loading from striking obstructions, such as stumps and stones, has been an age-old problem to man who has tilled the soil over the years. Many successful devices to cushion or reduce the impact loading on tillage equipment have been developed. A large number of patents have been issued on this subject, and several are dated prior to 1900. However, with tractors of greater horsepower and faster operating speeds, and farmers putting emphasis on more efficient operations, the search continues for a more effective solution to this problem.

It is the purpose of this paper to discuss individual spring-release beams which a number of implement manufacturers have incorporated in their moldboard plows within the past five years. This might appear to be a new development, but actually it is a very old idea applied to modern equipment.

We first realized the need for a safety device of this nature when developing moldboard plows for three-point-hitch tractors within the 30-45-hp range. Other manufacturers have also recognized this same problem and are utilizing the elastic plow-frame principle, a spring-release device for the entire plow, and individual-beam shear pins. It is our opinion that the additional cost of an individual beam spring-release device can easily be justified by added operator convenience and more positive protection to prevent operator injury or damage to tractor, plow and hitch.

After the individaul spring-release beams were proven to be satisfactory on mounted plows, it was recognized that there would be several advantages of utilizing the same arrangement on drawn plows. First, the conventional breakaway hitch would not be required, thereby eliminating the possibility of the plow becoming uncoupled from the tractor and requiring the operator to get off of the tractor to rehitch the plow and recouple the hydraulic hoses. Second, it would provide more positive protection to the plow share and bottom on multiple-bottom plows, since the required tripping load for the individual spring-release beams would be independent of the draft requirements of the other plow bottoms.

Without question this type of a safety device is a great convenience to the operator in stony fields. In comparison to the breakaway-type hitch a considerable saving of time may be realized. A number of time studies indicate that, when an obstruction disconnects the plow from the tractor, it requires approximately one minute for the operator of a tractor with a drawn plow to back up the tractor, dismount, rehitch the plow, recouple the hydraulic hoses, and mount the tractor. In contrast to this procedure it was found that with individual spring-release beams on a drawn plow the operator was able to back up the tractor and plow to relatch the tripped bottom in approximately eight seconds.

Referring to Fig. 1, it can be seen that it will take 16.1 percent longer to plow one acre with a two-bottom plow at ten trips per acre with a spring-release hitch as compared to a two-bottom plow with individual spring release beams, and for a three-bottom plow at ten trips per acre, 24.3 percent longer. It is obvious that with larger plows the individual spring-release beams become more advantageous.

Considering current labor rates and the cost per hour of operating a large tractor and plow, it is apparent that a considerable saving can be realized by using a moldboard plow with this feature. Fig. 1 indicates the saving in time only, and does not include the saving in tractor fuel, repair parts, and the intangible advantages of operator fatigue and earlier seedbed preparation.

There are several design considerations which require proper evaluation. First is the location of the horizontal pivot point which is probably the most controversial item. If the pivot point is located in a general area above the share point, the plow bottoms will rotate rearwardly with less ver-

Paper presented at the Golden Anniversary Meeting of the American Society of Agricultural Engineers at East Lansing, Mich., June, 1957, on a program arranged by the Power and Machinery Division.

The author — RICHARD T. BROWN — is general factory superintendent of the Oliver Corp., South Bend, Ind.

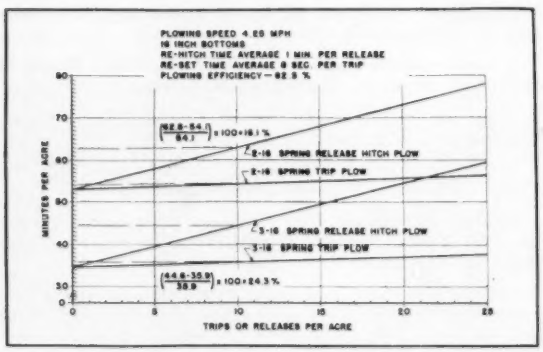

PLOWING SPEED 4.69 MPH
16 INCH BOTTOMS
RE-HITCH TIME AVERAGE 1 MIN. PER RELEASE
RE-SET TIME AVERAGE 8 SEC. PER TRIP
PLOWING EFFICIENCY — 82.5 %
MINUTES PER ACRE
TRIPS OR RELEASES PER ACRE
2-16 SPRING RELEASE HITCH PLOW
2-16 SPRING TRIP PLOW
3-16 SPRING RELEASE HITCH PLOW
3-16 SPRING TRIP PLOW

Fig. 1 Plowing time is compared for spring-trip and spring-release plows

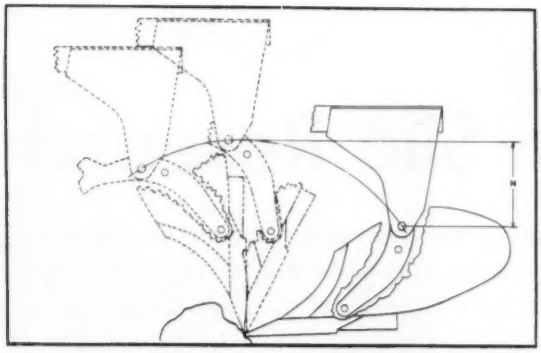


Fig. 2 Tripping action for spring-trip plow

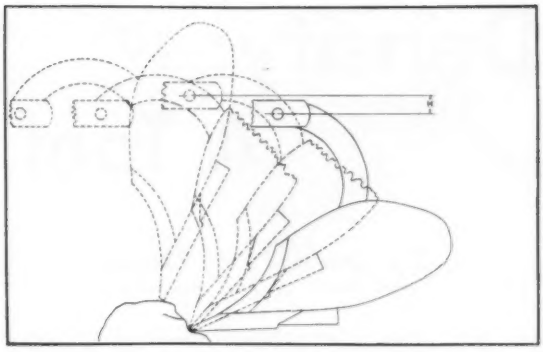


Fig. 3 Tripping action for trip-beam plow

tical travel (distance *H*, Fig. 3) in comparison to a pivot point location above and to the rear of the top edge of the moldboard (distance *H*, Fig. 2).

This can be an important consideration in five and six-bottom plows if the share section and the share fasteners are not of sufficient strength to lift the plow frame as indicated in Fig. 2. This problem is more pronounced on the middle plow bottoms since a large percentage of the weight of the plow is raised during the tripping operation. The pivot point location as illustrated in Fig. 2 was selected after due consideration of this problem because it is easier to relatch a tripped plow bottom, since a portion of the plow weight is supported on the share point. This design also permits a simpler frame design, and the loads in the spring-trip assembly are much smaller.

Second, the design must provide maximum tripping efficiency and trip consistently within an acceptable impact loading range. From Fig. 4 we can see that a large counter clockwise torsional movement is obtained when striking an obstruction slightly to the rear of the point of the share with a pivot point location as illustrated in Fig. 2. With a pivot point location as indicated in Fig. 3, a large clockwise movement is obtained when the wing of the share strikes an obstruction. Without a carefully constructed assembly it is possible for this torsional loading to prevent tripping with either pivot point location.

Third, it is necessary in any mechanism of this type to maintain a relative constant coefficient of friction in all bearings and on sliding surfaces if maximum tripping efficiency is expected to be obtained. In the mechanism that is illustrated in Fig. 5, approximately 38 percent of the tripping load is a result of frictional forces. With a wide variation in the frictional forces erratic tripping results will be obtained. This device is constructed with a mechanical advantage of five-to-one, a spring rate of 550 lb per in, and an average static tripping load of 4,000 lb. Operating conditions and exposure to weather present some major design problems in this connection.

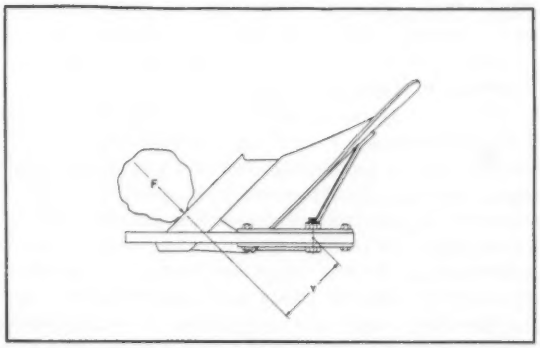


Fig. 4 Diagram of torsional loading for spring-trip mechanism

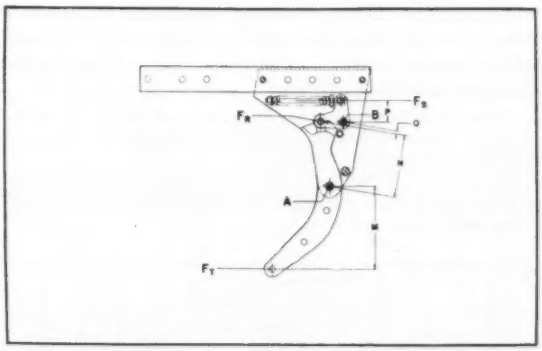


Fig. 5 A relative constant coefficient of friction in all bearings and on sliding surfaces must be maintained if maximum tripping efficiency is to be obtained. In this mechanism approximately 38 percent of the tripping load is caused by friction.

Conclusion

With larger horsepower tractors, faster operating speeds, the trend to mounted and semimounted equipment, and the farmers' demands for more efficient operations, it appears logical that an increasing number of plows with individual spring-trip beams will be required. In this event improved designs for maximum tripping efficiency should be expected.

Footnote: Neglecting friction and summing moments about points A and B:

Let F_T = tripping force

Let F_R = force between beam foot and roller

Let F_S = spring load

Let $\Sigma M_A = O$

$O = F_T M - F_R N$

(1) $F_T M/N = F_R$

Let $\Sigma M_B = O$

$O = F_R O - F_S P$

(2) $F_R O/P = F_S$

Combining (1) and (2)

$F_T(M/N)\ (O/P) = F_S$

Density: A Tool in Silo Research

C. K. Otis and J. H. Pomroy
Member ASAE Assoc. Member ASAE

Density measurements at various depths provide reasonable explanations for unpredictable behavior of silage in regard to forces exerted upon silo walls

DENSITY or volume weight of any stored material is an important factor in the design of storage structures. Physical dimensions are determined from such knowledge. Forces due to the stored material that must be resisted by the structure are related to various factors including the density of the stored product.

Silage is a material whose behavior is difficult to predict. It acts somewhat like a liquid and somewhat like a solid but has few physical properties in common with either. It is a fibrous material. Unlike whole grain, particles of alfalfa silage are not of uniform shape and size, but vary from thin delicate leaves to portions of coarse stem, characteristic of a first cutting. In corn silage the variation in particles is even more pronounced having parts of tassels, leaves, stalk and partially matured cobs and kernels. It is compressible so that density varies from bottom to top of the mass. The average density of a mass of silage depends on a number of factors that include the species of crop ensiled, moisture content, length of cut, maturity, proportion of leaves to stems, grain to stems, etc., and is probably affected by addition of preservatives and by methods used in filling the silo.

Paper prepared expressly for AGRICULTURAL ENGINEERING. Approved as Scientific Journal Series Paper 3776 of the Minnesota Agricultural Experiment Station.

The authors — C. K. OTIS and J. H. POMROY — are, respectively, professor and instructor of agricultural engineering at the University of Minnesota.

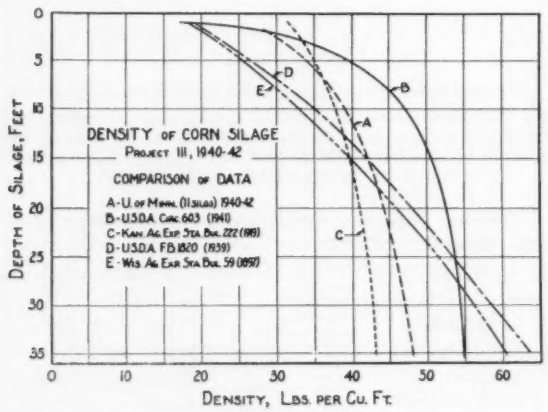


Fig. 1 A variety of silage density curves exists. Minnesota curve (A) is compared with curves based on other commonly referred to studies of corn silage density

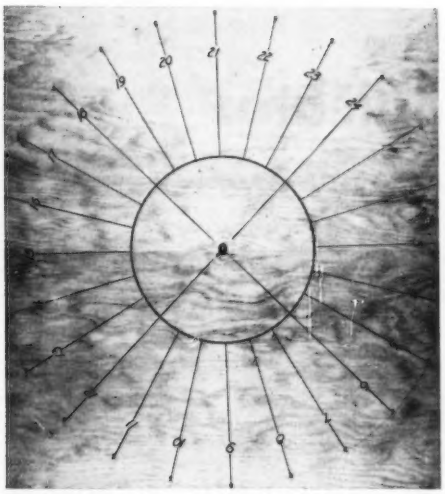
During the seasons of 1940-41 and 1941-42 density studies pertaining to corn silage were made in an attempt to determine why existing data for upright silos were not reliable when applied to Minnesota conditions. Fig. 1 shows the Minnesota curve based on the contents of 11 silos compared with curves from other sources as indicated. Comparing the data, on which these curves are based, revealed that curve B was determined from corn containing an average moisture content of 72.4 percent, the Minnesota curve A was determined from corn having an average moisture content of 68.6 percent, while curve C was found by working with corn having an average moisture content of 65 percent. Probably corn silage put up with a field cutter would provide still another curve.

McCalmont, et al (3)* have shown that the diameter of the silo has an effect on the unit lateral pressure exerted on the walls of the silo, so it appears that density of the silage would also be affected by silo diameter. There was some evidence in the Minnesota studies that diameter affected the average density curve, but there were insufficient data to draw any conclusions. Perkins, et al (6) have shown by laboratory studies that length of cut affects the density of the stored crop and have shown how density is affected by pressure.

Density Determination

Several methods have been used for determining the density of silage in a silo. The *layer method* is usually considered the most reliable, but is always subject to error because of the large number of cartloads that must be individually weighed in unloading the silo as the silage is fed and because of "springback" in the silage as weight is removed. The method consists of establishing a suitable bench mark at the top of the silo to which all elevations are referred. An engineer's hand level equipped with a clamp for clamping to a steel tape can be hung from the bench mark to obtain the elevation of the instrument. This elevation establishes a reference plane to which rod readings can be taken from the surface of the silage. A grid system for systematically selecting points for rod readings can be established and a fairly accurate average elevation of the silage surface can be obtained. Lines stretched between steel pins serve as guide lines for the grid. Rod readings are taken at the wall and at line intersections. A protractor such as shown in Figure 2 is helpful in determining the average radius of the silo from which the cross-sectional area of the

*Numbers in parentheses refer to the appended references.



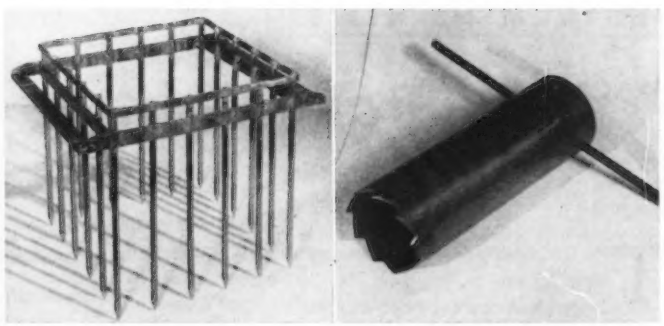


Fig. 2 *(Left)* A protractor can be used for determining the average radius of a silo used in calculating the cross-sectional area of the silo • Fig. 3 *(Center)* A surface sampler that, when forced into the silage, encloses 1 cu ft of silage. Sample is cut out with a hay knife • Fig. 4 *(Right)* A cylindrical surface sampler. Diameters of 6-in O.D. and 4-in O.D. were used. Sample was cut by the teeth formed at the end of the cylinder when it was turned while pressed against the silage

silo at each level can be obtained. This board is placed at the approximate center of the silo and a steel tape is lined up between the center pin and one of the lines on the protractor. The average of 24 tape measurements around the wall of the silo gives the average radius of the structure at that level.

By accurately determining the cross-sectional area of the silo at a given level and the average elevation of the top and bottom of a layer of silage the volume of silage removed can be calculated. After the silage removed from this layer has all been weighed the average volume weight of the layer can be calculated.

Knowing the elevation of the center of the layer in relation to the original settled surface one point on a depth-density curve can be located. Repeating this procedure at regular intervals from top to bottom of the silo will produce the completed curve.

Another method is the surface *sample method* that consists of removing a measured small volume of silage and weighing the removed silage giving a spot density. This method assumes that uniform density exists within the layer represented by the sample. The elevation of each of these samples must be determined to provide the data needed for the depth-density curve.

Two samplers used for surface sampling are shown in Figs. 3 and 4. The cubic-foot sampler, Fig. 3, is a frame built of sharpened steel rods arranged around a 1-ft square. The rods are forced into the silage surface until the side projections at the top are in contact with the silage surface indicating a 1-ft depth. A hay knife is then used to cut free the sides of the sample inside the enclosure formed by the rods. The silage is then removed to the bottom of the pointed rods and weighed. The weight represents the density of the silage in pounds per cubic foot at that level in the silo. Another surface sampler is shown in Fig. 4. This is a core sampler made from a 2-ft length of 6-in O.D. seamless steel tubing $\frac{3}{16}$ in thick. It is used as follows: A board about 18 in by 24 in is provided with a hole just large enough for the core sampler to pass through. This board is laid on the surface of the silage at the point where the sample is to be obtained. A surveyer's level rod is then placed on the silage exposed at the hole and the elevation of the silage surface determined accurately. The sharp-toothed end of the sampler is then inserted in the hole and a core of silage cut by turning the tube back and forth while applying pressure at the top. The sampler is removed with the core remaining inside until forced out into a container for weighing. The rod is again inserted into the hole to establish the elevation of the bottom. Knowing the inside diameter of the tube, the depth of the hole and the weight of silage removed, the density in pounds per cubic foot can be calculated.

Fig. 5 shows four depth-density curves for the same silo using the layer method, the cubic-foot sampler and two core samplers, one 6 in and the other 4-in O.D. Although not all densities obtained by surface samples in other silos showed the same tendency, it was felt that most often the surface samplers gave relatively high values of density at the top of the silo and relatively low values near the bottom of the silo.

It will be shown later that springback of the silage as the weight is removed, is a factor to consider when using either the layer or the surface sampling methods.

(Continued in December)

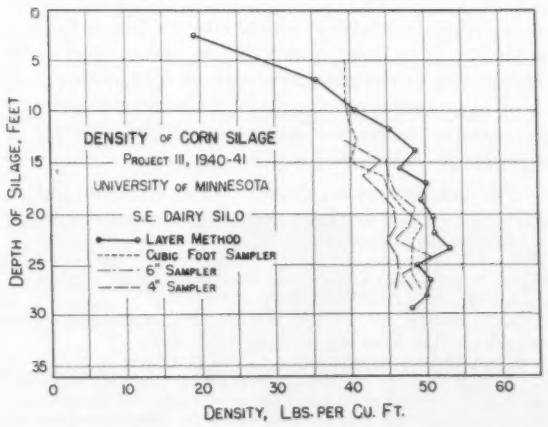


Fig. 5 Results of density determinations by the layer method and by three different surface samplers

INSTRUMENT NEWS

Grain Moisture Indicator

W. V. Hukill
Fellow ASAE

Pipe cleaner, as sold at tobacco counters, supplies inspiration for practical grain moisture indicator

THE requirements of a remote reading moisture indicator for use in studying grain drying are somewhat different from those of other grain moisture measuring equipment. For this purpose it is much less important to determine the exact moisture content at a given point in the bin than it is to determine as accurately as possible the time when a drop in moisture occurs at that point. This is because of the way drying proceeds in a bin. During drying with unheated air, the moisture history of any kernel of grain follows a pattern that is typical of any other kernel in the bin except those near the air entry. The moisture content changes little if at all for a period, it then drops relatively quickly, and finally remains about constant during the remainder of the drying period. The time elapsed, before the drop in moisture, varies in different parts of the bin, depending upon the volume and distribution of air flow. When the air flow is not linear, kernels in the bin relatively close together may reach the stage of dropping moisture content at widely different times so that sharp gradients in moisture content may exist during drying. In studying the effect of air distribution on drying, knowing just when the drop in moisture occurs at a given location is of more significance than knowing the exact moisture content at any particular time.

This situation makes the selection of moisture indicating equipment for studying drying somewhat different from selecting equipment for many other purposes. For this use some degree of precision of moisture reading can be sacrificed and the requirement for small size is of greater importance. For this purpose also an instrument should be expendable or cheap because to study moisture gradients, readings at large numbers of locations are necessary. It is also important to avoid any instrument, the presence or use of which will appreciably influence the air flow or the rate of change in moisture content of the grain. With these modifications of the usual requirements for moisture indicating equipment in mind, a device has been made and used that answers the purpose reasonably well even though it might not be well suited for other purposes.

The moisture sensing element consists of a short section of pipe cleaner about 2½ in long. A pipe cleaner, the type that is sold at tobacco counters, is essentially a crude brush having short fibers that are caught and held between two wires twisted together. The fibers are hygroscopic, that is, their moisture content tends to come to equilibrium with the humidity of the surrounding atmosphere. The two wires are in electrical contact with each other only through the fibers so that if an electromotive force is applied across the wires the current flow depends upon the conductivity of the fibers which is in turn affected by their moisture content. By suitable calibration the resulting current flow can be translated to the moisture content of grain in which the unit is buried.

Such a unit is made by untwisting the wires of the pipe cleaner for a short length, say ¼ in, and soldering a copper lead to each of the two wires. In order to enable temperature measurements, a length of constantan wire is soldered to one of the copper wires. The one constantan and two copper wires of suitable length extend from the sensing element to a reading instrument. By imposing an emf across the two copper wires and measuring the current flow a reading of the electrical resistance is taken. By connecting the constantan and one of the copper leads to a potentiometer a reading of temperature is taken. The readings of resistance and temperature may be translated to approximate moisture content.

The electrical resistance of a unit varies in the range between 10,000 ohms and one megohm. Twelve volts have been used as the potential across the terminals. It is desirable to use alternating current for measuring the conductivity because of the tendency for polarization to occur when direct current is used.

The precision of this unit for exact measurements is limited by a tendency for the reading to be higher if the equilibrium is approached from a wet condition than if from a dry condition. In use this difficulty is reduced by always dipping the sensing element in water before it is buried in the grain. By using this precaution readings can be duplicated within one or two percent moisture. During calibration it was found necessary to leave the unit buried in the grain for several hours to permit equalization of the moisture between the grain and the sensing element. Obviously, failure to read grain moisture content closer than one or two percent would make the equipment unsuitable for some purposes. However, for detecting moisture gradients in drying grain it has proven useful. We have made, calibrated and used 400 to 500 such elements in various drying tests at Ames, Iowa.

Paper prepared expressly for AGRICULTURAL ENGINEERING. Journal Paper No. J-3114 of the Iowa Agricultural Experiment Station. Project No. 1296 (USDA cooperating).

The author W. V. HUKILL — is principal agricultural engineer, ARS, USDA, Iowa State College, Ames, Iowa.

INSTRUMENT NEWS (Karl Norris, Editor) is sponsored by the ASAE Committee on Instrumentation and Controls. Contributions on agricultural applications of instruments and controls and related problems are invited, and should be submitted direct to K. H. Norris, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

Nominations Announced for 1958-59 ASAE Officers

Nominations for elective officers of the American Society of Agricultural Engineers for 1958-59, have been reported by the Nominating Committee, F. B. Lanham (chairman), E. T. Swink, M. M. Jones, C. K. Otis and C. F. Kelly. Voting will be by letter ballot to be mailed to voting members in February. Closure of voting will be March 31. Vacancies to be filled are those due to expiration of terms of office of three members of the Council at the time of the annual meeting in June, 1958, and five members of the nominating committee. The nominees are as follows:

Nominee for President

Eugene G. McKibben was born in 1895 at Almyra, Ark. His parents were natives of Marshall County, Iowa, and resumed residence there for a time, during which he attended the Marshalltown High School. Upon graduation in 1916 he entered Iowa State College as a student in agricultural engineering.

World War I intervened, and for two years following June of 1917 he was in the U.S. Army Ambulance Service, having enlisted in the Iowa State unit shortly after its formation. He served overseas, in Italy, for nearly a year, and in the fall of 1919 resumed his course at Iowa State College. Here, and also in high school, he was a football player and a wrestler. He received a B.S. degree in agricultural engineering from Iowa State in 1922.

As an undergraduate, Dr. McKibben was a member and for two years president of the Adelante fraternity. He also became a member of four honorary scholastic fraternities — Tau Beta Pi, Alpha Zeta, Gamma Sigma Delta, and Phi Kappa Phi — all that were open to agricultural engineering students. He was president of the College YMCA in 1921-22.

Following graduation from Iowa State College he joined the agricultural engineering staff of the University of California where he served successively as assistant, instructor, and assistant professor for six years. In 1927 he received an M.S. degree in agricultural engineering from the University and was elected to Sigma Xi. That year also marked the publication, in AGRICULTURAL ENGINEERING, of his first major and still most monumental research series, "The Kinematics and Dynamics of the Wheel-Type Farm Tractor."

In 1928 he returned to Iowa State College as associate professor in the agricultural engineering department. Here he remained for 14 years, less interruptions. One was the summer of 1930, which he devoted to research in field power and machinery at Pennsylvania State College. The other was a period during 1935 and 1936, when he was a research fellow on leave for graduate study. At the end of that period of study, Iowa State College awarded him the degree of Ph.D. based on a joint major in agricultural engineering and soils, and a minor in mathematics. A part of his work at Iowa was the teaching of dairy engineering, and he is credited with complete reorganization of that course.

Dr. McKibben left Iowa in 1942 to become professor and head of the agricultural engineering department at Michigan State College where he re-established the professional curriculum in agricultural engineering. He remained at Michigan State until May of 1945. Meanwhile there were other assignments such as the WPA national research project in 1937, consultant to the farm machinery division of the War Production Board in 1943, and to the Aberdeen Proving Ground of the War Department in 1945.

Nominee for President

EUGENE G. MCKIBBEN

From June 1945 to May 1950 he was head of the agricultural engineering department of the Pineapple Research Institute, Honolulu. He joined the U.S. Department of Agriculture, BPISEA, Farm Machinery Division in June 1950 and remained until February 1952. He was in charge of Tillage Machinery Laboratory at Auburn, Ala. He became chief of Agricultural Engineering Research Branch of USDA in 1952 and in 1957 director of the Agricultural Engineering Research Division (ARS) USDA.

In service to ASAE, Dr. McKibben has, along the years, acted as member of various committees in the Power and Machinery and College Divisions. He was chairman of the College Division in 1938 and member of its advisory committee for two years prior. In 1938 and 1939 he had charge of a cooperative project on pneumatic tires for agricultural machines. He served on the nominating committee in 1940 and was chairman in 1953. He served as a member of the Council from 1941 to 1943. He was awarded the Cyrus Hall McCormick Medal in 1949 for his record of distinction in administration and instruction as well as in research.

Nominees for Vice-President

J. W. BORDEN

A. J. WOJTA

Nominees for Vice-President

John W. Borden was born in St. Louis, Mo., but grew up in Colorado Springs, Colo. He received a B.S. degree in civil engineering at the University of Colorado in 1938. After graduation he served as surveyor with the city engineer at Colorado Springs, for a short period. Then he spent 18 months with the U.S. Bureau of Reclamation at Denver in the Preliminary Arch Dam design section.

In 1940 he accepted a position as stress analyst at Ryan Aero Co. in San Diego, Calif. For the next seven years he served in various capacities including chief of structures, chief project engineer, chief administrative engineer and assistant chief engineer.

Mr. Borden returned to Denver in 1947 as a sales correspondent with Eversman Manufacturing Co. His present position is vice-president in charge of sales and advertising.

He joined ASAE in 1951 and served as chairman of the Rocky Mountain Section in 1953. He has been on a number of ASAE committees and is currently chairman of the Drainage Group, Soil and Water Division, and a member of the Steering Committee of that Division.

Mr. Borden resides with his wife, Edith, and four children at Littleton, Colo., and is a member of the Presbyterian Church.

Alfred J. Wojta was born near Menomonee, Mich., and reared in Wisconsin. He received a B.S. degree in agricultural engineering from the University of Wisconsin in 1931 and a B.S. degree in mechanical engineering in 1932. Following graduation, he became a heating and ventilation engineer for a local heating concern. From 1935 to 1946 he was employed by the Soil Conservation Service in various capacities as senior camp engineer, superintendent of four erosion control CCC camps, state safety and equipment engineer, district conservationist and area agricultural engineer.

Mr. Wojta received a civil engineer diploma from the International Correspondence Schools, Scranton, Pa., in 1946, and joined the staff at the University of Wisconsin as an assistant professor of soils and agricultural engineering. Two years later, he transferred to teaching and research in the agricultural engineering department. In 1953 he received an M.S. degree in agricultural engineering from the University. At present, he is associate professor of soils and agricultural engineering in the soils department.

He was chairman of the Wisconsin Grassland Field Days program and at present is

(Continued on page 810)

Nominees for Councilor

T. E. BOND

H. H. NUERNBERGER

. . . News

(Continued from page 809)

general manager of the Wisconsin Farm Progress Field Days program. He initiated, in co-operation with other staff members, in 1947, the land forming program designed to provide the ultimate in surface water control and ease of working field areas with large modern equipment.

He joined ASAE in 1939 and served as vice-chairman of the Soil and Water Division in 1952 and as chairman in 1953. In 1954 he was chairman of the Division's Steering Committee. He is now serving as chairman of the Surface Drainage Committee. He holds membership in the American Society of Agronomy, Soil Science of America, Soil Conservation Society, Wisconsin Chapter and National Society of Professional Engineers and Wisconsin Extension Workers Association.

He is state drainage engineer, member of the Water Regulatory Board and a professional engineer. He was elected to Alpha Zeta and Who's Who in the Midwest.

Nominees for Councilor

Theodore E. Bond was born at Tawanda, Kans., in 1917. He attended high school and one year of college in Manhattan, Kans. In 1948 he graduated from the University of California, Davis, with a B.S. degree in mechanical engineering with an agricultural engineering option. He earned an M.S. degree in agricultural engineering with a minor in civil engineering from Iowa State College in 1951. He was inducted into the U.S. Army in 1943 and served overseas in Italy with the 4th Corps Headquarters Engineers Section.

Since 1948 Mr. Bond has been associated with what is now the livestock engineering and farm structures research branch of the Agricultural Engineering Research Division of USDA, at the University of California. His primary interest has been research in farm structures aimed chiefly toward investigation of the effects of environment on livestock, and the resultant influence of these effects on the design of livestock structures. He has obtained calorimeter data for swine that provide a foundation for design of ventilation systems and environment control for swine housing. Along with coworkers, he has been instrumental in establishing and evaluating, through research, engineering and management methods for increasing hot-weather production of beef cattle. Many of the results of this work are now applied in farm and commercial feed lots.

Other research experience includes: study and measurement of solar radiation and its modification and control in and around livestock structures; exploratory investigations of feasible utilization of the cold sky as a radiation sink for livestock; intensive studies of animal shades, their design and orientation, and roof materials for optimum protection; study and application of instruments and instrumentation for use in farm buildings research; and, application of various means of modifying climatic and environmental conditions for livestock.

He joined ASAE in 1948 and has served on committees for animal shelter ventilation, subject matter classification, and Technical Advisory Committee on plant and animal husbandry. He also is a member of Phi Kappa Phi, Gamma Sigma Delta, and Sigma Xi fraternities.

Howard H. Nuernberger was born and raised on a farm near Wakefield, Nebr. He attended the University of Nebraska and received a B.S. degree in electrical engineering and in commercial engineering in 1939.

Following graduation he was with the U.S. War Department, Omaha, Nebr., as a company commander in the Civilian Conservation Corps. In 1942 he joined the Aluminum Company of America as a project construction engineer and had charge of the construction of the first magnesium permanent mold plant in the United States at Cleveland, Ohio. Later he was appointed as development engineer on applications of magnesium products. He transferred to the Sales Development Div., Alcoa, in New Kensington, Pa., in 1944, where he now is head of the agricultural section. He has served as administrator of research grants made by the College Relations Committee of his company to the University of Illinois, Iowa State College, and Texas A & M College for the purpose of studying the applications of aluminum in farm structures and farm machinery.

Mr. Nuernberger has been active in ASAE since joining in 1950. He served as a member of the local arrangements committee for the annual meeting in Pittsburgh in 1953 and was chairman of the Pennsylvania Section in 1956. In 1954 he was appointed to the Farm Structures Steering Committee for a one-year term and reappointed in 1955 for a three-year term. He was the chairman of the Sprinkler Irrigation Association Technical Committee that prepared the "Minimum Standard for Irrigation Equipment" which was approved as an ASAE Standard. He is a registered professional mechanical engineer in the state of Pennsylvania.

Nominees for Nominating Committee

Frank W. Andrew, extension agricultural engineer in farm electrification, University of Illinois. Has served in ASAE as chairman and vice-chairman of Extension Exhibits and is now chairman of the Extension Committee.

John R. Carreker, superintendent of the Southern Piedmont Conservation Experiment Station, (SWCRD, ARS), USDA, and agricultural engineer, College Experiment Station, University of Georgia. ASAE committee activities and offices held include: Chairman of Georgia Section; vice-chairman, Southeast Section; committee on agricultural hydrology; committee on farm ponds and reservoirs; committee on paper awards; subcommittee on terrace specification; chairman of erosion control group of Soil and Water Division; Steering Committee of the Soil and Water Division, and vice-chairman of the Soil and Water Division.

Norval H. Curry, professor of agricultural engineering, Iowa State College, Ames, Iowa. He joined ASAE in 1943 and has served as chairman of the Farm Structures Division, as member of the Meetings Committee, and as member of the Committee on Farm Structures Research. Presently he is chairman of the Committee on Farm Building Construction Standards.

Sherwood S. DeForest, associate editor of *Successful Farming* magazine, Des Moines, Iowa. He has served on the nominating committee for the newly formed Iowa Section, as a member of the Farm Structures Division Steering Committee and is vice-chairman of the Farm Structures Division.

Robert B. Hickok, project engineer, site selection and master planning, Holmes and Narver, Inc., engineers and constructors, Los Angeles, Calif. He has served as chairman of ASAE Soil and Water Division, Soil and Water Division Steering Committee, committee on subject matter classification, and as a member of the Technical Standards Committee.

C. H. Jefferson, agricultural engineer and consultant, Farm Institute, Reynolds Metals Co., Louisville, Ky. When chairman of the Farm Structures Division of ASAE, he was instrumental in the setting up of the Steering Committee organization. Later he served as a member of the Steering Committee and of the committee on teacher training.

Morris H. Lloyd, agricultural engineer, Niagara Mohawk Power Corp., in charge of rural electrification program in the Western division. In ASAE activities he has been chairman of the Rural Electric Division, secretary and later chairman of the North Atlantic Section, and is now chairman of the committee on animal shelter ventilation.

J. Roberts, chairman, agricultural engineering department, State College of Washington. He is a member of the personnel for inspection committees, accrediting program, Engineers Council for Professional Development; the National Joint Committee on Fertilizer Application; Research Conference Committee on the USDA Farm Electrification Section; and the Fertilizer Application Committee. He is also chairman of the Education and Research Division.

L. H. Skromme, chief engineer, New Holland Machine Co., Division of Sperry Rand Corp. He has served ASAE as national president of ASAE student branches; chairman of the committee on student branches, and of the committee on technical paper awards; as a member of the Power and Machinery Steering Committee, and Nominating Committee of the North Atlantic Section; and as vice-president of ASAE.

Carlton L. Zink, product research dept. of Deere and Company. In ASAE activities he has served as chairman of the Power and Machinery Division and of the Student Branch Committee, and is a member of the committee on farm safety.

(Continued on page 812)

ASAE MEETINGS CALENDAR

November 14-15—WEST VIRGINIA SECTION, Jackson Mills, West Va.

November 15 - 16 — VIRGINIA SECTION, Blacksburg.

November 22 — QUAD CITY SECTION, the Tower, 30th Ave. and 7th St., Moline, Ill.

November 22-23 — TENNESSEE SECTION, Nashville, Tenn.

December 6 — OKLAHOMA SECTION, place not announced.

December 15-18—WINTER MEETING, Edgewater Beach Hotel, Chicago, Ill.

January 10 — WASHINGTON, D.C. SECTION, USDA, South Bldg., Washington, D.C.

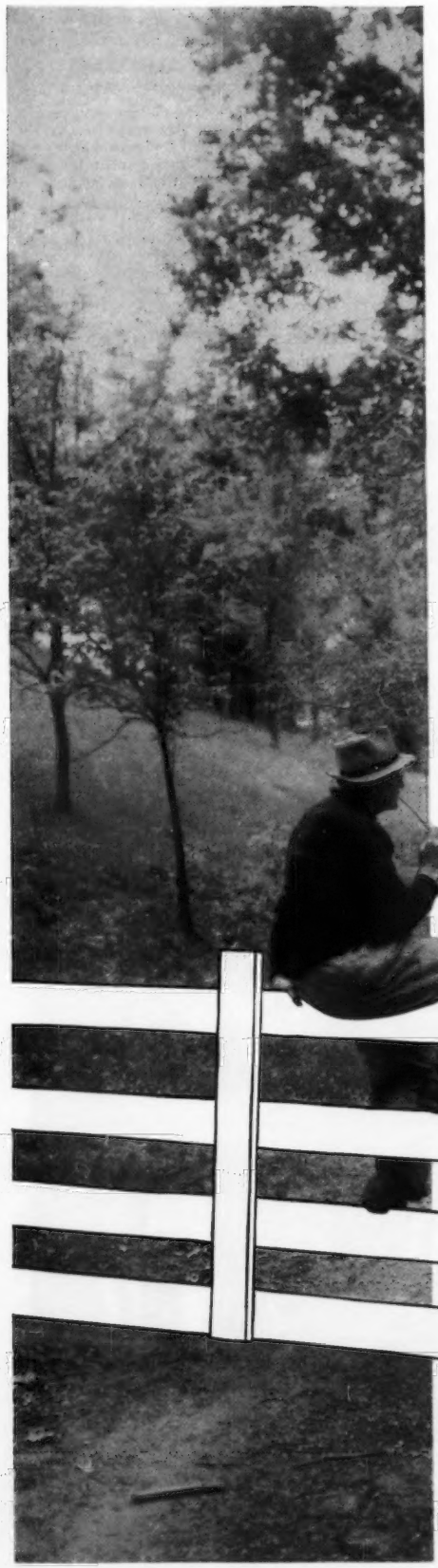
January 30-31 — PACIFIC COAST SECTION, University of California, Los Angeles, Calif.

February 3-5—SOUTHEAST-SOUTHWEST SECTION meeting, Little Rock, Ark.

March 28-29 — ROCKY MOUNTAIN SECTION, Engineering Center, Colorado State University, Fort Collins, Colo.

June 22-25 — 51st Annual Meeting, Santa Barbara Campus, University of California, Santa Barbara, Calif.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.



Lend to me Your winds.

Let them stir
This laggard heart of mine,
Give life to this
My torpid gratitude
And bear it heavenward.

Permit each rustling leaf,
Each air-borne spray,
Each silken murmur
Of the winnowed grass
To be my fervent prayer
Of thanks.

Lend the lightning to me.

Allow it, if You will,
To rend this vaulted soul,
To shatter every selfish thought,
And wither with its heat
Each growing weed
Of petulance.

Command its glowing point
To touch and aggravate to flame
The smouldering kindling
Of my gratefulness.

Let me borrow of the thunder.

Let me steal its strength
And let its rolling loudness
Add volume to the smallness
Of my voice.

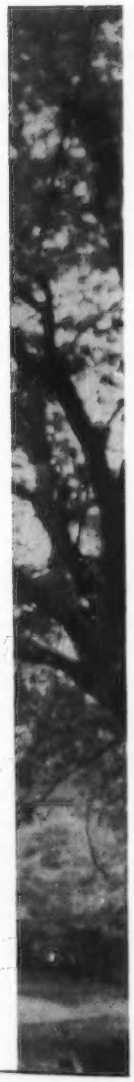
From it, let me draw
The courage to withstand
The tempting comforts
Of my passiveness,
And wake me to acute awareness
Of my dependency on You.

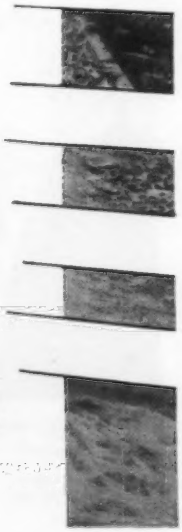
And of Your rain and snow
Let me partake.

Let them cleanse
This mind, this heart, this soul
Of the self-imprinted stains
Which are the telltale marks
Of gross conceit.

Permit them to refresh the memories
Of countless blessings,
Of mercies undeserved,
And rewards unmerited.

Put, for just one day,
Your elements within my hand
To magnify and swell
My small and soundless
"Thanks!"





Thanksgiving, 1957

JOHN DEERE
MOLINE, ILLINOIS

Copyright, 1957
John Deere • Moline, Illinois

. . . News

(Continued from page 810)

Tillage and Traction Seminar

Top officials, executive and research engineers of 35 major farm machinery and tire manufacturers; directors of the state agricultural experiment stations; agricultural engineering department heads and staff members of several colleges and universities; administrators and directors of USDA Agricultural Research Service and divisions; representatives of the Waterways Experiment Station, Vicksburg, Miss.; Land Locomotion Laboratory, Detroit arsenal of the U.S. Army Corps of Engineers, were in attendance at a two-day seminar on tillage and traction equipment research, October 24 and 25. The seminar was held at the National Tillage Machinery Laboratory and the Alabama Polytechnic Institute under the sponsorship of the USDA Agricultural Research Service and the API Agricultural Experiment Station. Its purpose, well accomplished, was to discuss mutual problems of public and private agencies in improving and developing equipment for soil management and to formulate methods and procedures for cooperative effort in future developments.

"Agricultural engineering research areas needing emphasis in the future are simplification, mechanization, and automation of livestock care, including design and arrangement of both structures and equipment," T. C. Byerly, deputy administrator, Production Research, Agricultural Research Service, USDA, stated during a luncheon meeting on Thursday. Mr. Byerly suggested that simplification and adaptation of machines for small farms, determination of causes and elimination of breakage in machine parts and simplification of repair are to be desired. He pointed out that the tillage research, such as being carried on at the Auburn laboratory, is very essential to soil and water research in evaluating the relationship of physical structure of soil to its productivity.

The value of cooperative research between farm equipment industry and public research institutions was stressed by Dr. M. L. Nichols, director of the National Tillage Machinery Laboratory. He pointed out that if American industry is to maintain its position of world leadership and progress in tillage, traction and traffic fields, research information is necessary. He encouraged the getting together of companies and agencies concerned to formulate a program to meet a common need, as a most logical and economical course.

A tour of the Tillage Machinery Laboratory on Thursday afternoon gave all an opportunity to observe projects, now in operation, dealing with physical reactions of soils to tillage tools; disk blades; soil compaction; subsurface tillage; tires and tracks for traffic and traction; effects of implements on soil physical condition, and methods and equipment for measuring force distribution in soils.

W. H. Allaway, assistant director, SWCRD, ARS, USDA, opened the second day session with a talk on the relationship between tillage and crops. A panel on equipment and soil relations research needs, W. M. Carleton, assistant director, AERD, ARS, USDA, panel leader, rounded out the morning program. Tillage equipment was discussed by T. L. Mullen, chief engineer, Rome Plow Co.; traction by W. H. Worthington, director of research, John Deere Research and Engineering Center; transport by P. J. Forrest, manager, farm tire development, U.S. Rubber Co., and trafficability by C. R. Foster, chief, flexible pavement branch, soils division, Waterways Experiment Station, Vicksburg, Miss. Such interesting information as the use of computers for farm machinery design, cost versus efficiency in tillage equipment design, and a reduction in manhours in field testing were discussed. During a Friday luncheon meeting E. G. McKibben, director, AERD, ARS, USDA, discussed plans for the National Tillage Machinery Laboratory and pointed out the opportunity that exists for industry to arrange for research to be worked out on a mutual-benefit basis. He encouraged more participation by industry or other agencies interested in the research that can be done with the laboratory facilities.

A special surprise tribute was paid Dr. M. L. Nichols, director of the National Tillage Laboratory, and J. B. Wilson, retired extension agricultural engineer, during a banquet held Thursday evening. J. B. Wilson, who had been in on the surprise for Dr. Nichols, had headed the committee for selecting a television set and an oil painting of Dr. Nichols. The unveiling of a painting also of J. B. Wilson added a perfect climax to the evening. A ceremony on Friday morning dedicated both paintings for permanent display in the API agricultural engineering building.

EVENTS CALENDAR

November 18-22 — The Golden Anniversary Meeting of the *American Society of Agronomy*, Atlanta Biltmore Hotel, Atlanta, Ga. New developments in crops and soils research will be reported.

December 1-6 — *The American Society of Mechanical Engineers*, Statler and McAlpin Hotels, New York, N. Y. Topics to be discussed include new aircraft, solar power, metal processing, nuclear energy, safety, education and plastics. For further information write the ASME Meetings Dept., 29 West 39th Street, New York 18, N. Y.

December 9-12 — The 23rd annual convention of the *National Junior Vegetable Growers Association*, Hotel Abraham Lincoln, Springfield, Ill.

December 26-31 — Annual meeting of the *American Association for the Advancement of Science* will be held in Indianapolis, Ind. More information will be available at a future date.

January 30-31 — *College-Industry Conference* of the American Society for Engineering Education will be held at the University of Michigan, East Lansing. The theme is on new concepts in the education and development of technical manpower. For more information write to Harold M. Dent, chairman, Subcommittee on Invitations, General Motors Institute, Flint, Mich.

February 3-5 — Association of Southern Agricultural Workers, Marion Hotel, Little Rock, Ark.

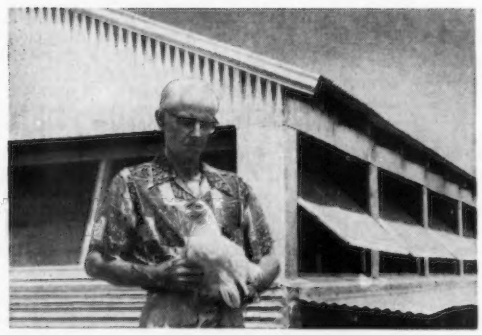
February 9-15 — Observance of *National Electrical Week*. The objective will be to create a nationwide spotlight on the contributions of electricity and the electrical industry to our American economy and way of life.

February 25-26 — Sixth Annual *National Dairy Engineering Conference*, Kellogg Center, Michigan State University, East Lansing. Sponsored by the agricultural engineering and dairy departments. For more details write Carl W. Hall, Agricultural Engineering Dept., Michigan State University, East Lansing.

March 16-21 — *1958 Nuclear Congress* will be held at the Chicago Amphitheatre, Chicago, Ill. Further details later.

Unveiling of two portraits highlighted a banquet held in conjunction with a tillage and traction seminar, October 24 and 25, at Alabama Polytechnic Institute. *(Left)* E. C. Easter, executive vice-president, Alabama Power Co., at left, made the presentation to Dr. M. L. Nichols for his service as head of agricultural engineering, API, 1919-35; chief of research of SCS until 1953, and director of National Tillage Machinery Laboratory since 1953. • *(Right)* F. A. Kummer, head of agricultural engineering, API, at right, presented the portrait to J. B. Wilson in recognition of his service as extension agricultural engineer, 1927-49; consultant to War Production Board, 1941-49; secretary of Alabama Farm Equipment Dealers Association, 1944-49; and consultant for the Ford Motor Co., 1949-55. Both portraits will be displayed in the API agricultural engineering building

Will headlines like this worry you next summer?



ANDY RAINWATER, Office Manager, Springdale (Ark.) Farms

Not this man . . .

his flocks are covered with Kaiser Aluminum Roofing

Last summer a heat wave in northwest Arkansas wiped out 25,000 birds in one day . . . farmers reported losing up to 40% of their flocks.

But some flocks weathered the killing heat with losses of less than one-half of one per cent! Why? Because they were covered with *heat reflective* Kaiser Aluminum Roofing.

Andy Rainwater, pictured above, reports that Springdale Farms lost only 16 broilers out of 3600. Says Mr. Rainwater, "Our Kaiser Aluminum covered broiler house stayed many degrees cooler. We didn't have to use fans, water sprinklers or any other mechanical cooling methods."

Kaiser Aluminum Roofing reflects hot sun rays to keep poultry houses *up to 15 degrees cooler.* Broilers stay healthier, gain weight faster, give you bigger profits.

And, Kaiser Aluminum Roofing can't rust, never needs painting. It's lightweight, yet strong and durable with an unrivaled record of freedom from wind damage and nail pull-through.

Don't let next summer's heat waves kill your profits. Re-roof now with heat reflective Kaiser Aluminum Roofing. It's available in big 48″ wide sheets, standard 26″ wide sheets, and easy-to-use *Roll-On** rolls. Contact your nearest dealer and ask him about Kaiser Aluminum Roofing.

*Trademark

KAISER Aluminum

THE BRIGHT STAR OF METALS

For more facts circle No. 69 on reply card

Fred W. Roth has been appointed extension agricultural engineer for the Iowa State Extension Service, and **D. A. Brueck** as assistant county extension director.

Arthur H. Keller is now employed as divisional chief engineer with the International Harvester Co., East Moline Works, in East Moline, Ill. Formerly he was with the farm implement div. of the company in Chicago.

J. T. Clayton, formerly assistant professor of agricultural engineering at the University of Illinois, has joined the agricultural engineering staff at the University of Massachusetts as associate professor. He will be responsible for the department's programs and activities in teaching and research in the area of farm structures.

Mr. Clayton received a B.S. degree in agricultural engineering from the University of Tennessee and an M.S. degree from the University of Illinois. He has had experience as an extension agricultural engineer and as assistant professor of farm structures doing teaching and research. He is a registered professional engineer.

J. T. CLAYTON

T. W. HEMING

E. F. OLVER

D. F. WITHERSPOON

David F. Witherspoon, assistant professor of agricultural engineering, Ontario Agricultural College, Guelph, Ontario, Canada, has been granted a leave of absence for one year to study hydrology and reclamation at the Delft Technological University, Delft, Netherlands. His course of study is part of the International Course in hydraulic engineering sponsored by the Netherlands Universities Foundation for International Cooperation.

Elwood F. Olver, associate professor of agricultural engineering at the Pennsylvania State University, has been named director of a new department of security which has been established at the University. The department was established following a study made by a special committee on safety, waste disposal, and civil defense. Mr. Olver will work with safety committees and personnel in the various colleges and divisions of the University.

He joined the staff of the agricultural engineering department in 1946. His research in agricultural engineering has included work on grain and hay drying, livestock feed processing, automatic livestock feeding, and conveyor design. He is a member of the American Society for Engineering Education and of Sigma Xi. He joined ASAE in 1946 and is presently serving on the Rural Electrification Steering Committee. He has also been secretary and treasurer of the Pennsylvania Section. He is a registered professional engineer in Pennsylvania.

Thomas W. Heming has been promoted to manager of the Oakland (Calif.) regional sales office, Tractor and Implement Div., Ford Motor Co. He has been sales representative in the California regional office since 1947, first with Dearborn Motors Corp., then since 1953 with Ford Motor Co.

Mr. Heming attended high school in Los Angeles and studied engineering at California Institute of Technology at Pasadena. He also attended the business school courses of the YMCA Technical School at Los Angeles. He operates an orange grove in the San Fernando Valley, and is an active member of the National Flying Farmers Association, the Aircraft Owners and Pilot Association and the National Aeronautical Association. He has been a member of ASAE since 1955.

Paul D. Colbenson, field representative for Douglas Fir Plywood Assn., has been transferred from Birmingham, Ala., to Tampa, Fla.

Blaine F. Parker has accepted a position as associate professor of agricultural engineering at the University of Kentucky, Lexington. Formerly he was assistant professor of agricultural engineering at North Carolina State College, Raleigh.

R. A. Ramsay, formerly Detroit district manager of the Bearings Division of the Torrington Co., has been appointed sales manager of the Mechanics Universal Joint Division of Borg-Warner Corp., Rockford, Illinois.

John W. Sjogren has been promoted to professor of agricultural engineering at Virginia Polytechnic Institute, and **Bernard L. Parsons** to associate professor. Mr. Sjogren was formerly associate professor and Mr. Parsons, assistant.

Hodges M. Hastings, Jr., Virginia Electric and Power Co., Richmond, has been promoted from agricultural engineer to power sales engineer in the Commercial Department.

John B. Leonard, formerly agricultural engineer for Virginia Electric Cooperative, is now head of the engineering department.

Burton F. J. Cargill, extension agricultural engineer at Michigan State University, is on two years' leave doing graduate work at the University of Missouri, Columbia.

NECROLOGY

Osgood Murdock, secretary-treasurer of the Northern California Tractor and Implement Club, Oakland, Calif., died suddenly September 5. His death came 15 days after the Club had honored him with a special dinner meeting for his 38 years of service to the farm equipment industry of the West.

O. MURDOCK

Mr. Murdock was associate editor of the *Implement Record* from 1919 to 1927, becoming editor in 1928. In 1933 he purchased the publication and it became an influence in the industry as the voice of the farm equipment industry west of the Rockies. He sold the magazine to a trade publication chain in 1951, remaining for two years as its editor. He then opened his own office as consultant to the industry.

He was elected president of the Tractor and Implement Club in 1927 and became its permanent secretary-treasurer in 1936. During World War II he was called to Washington, D.C., as adviser to the War Production Board.

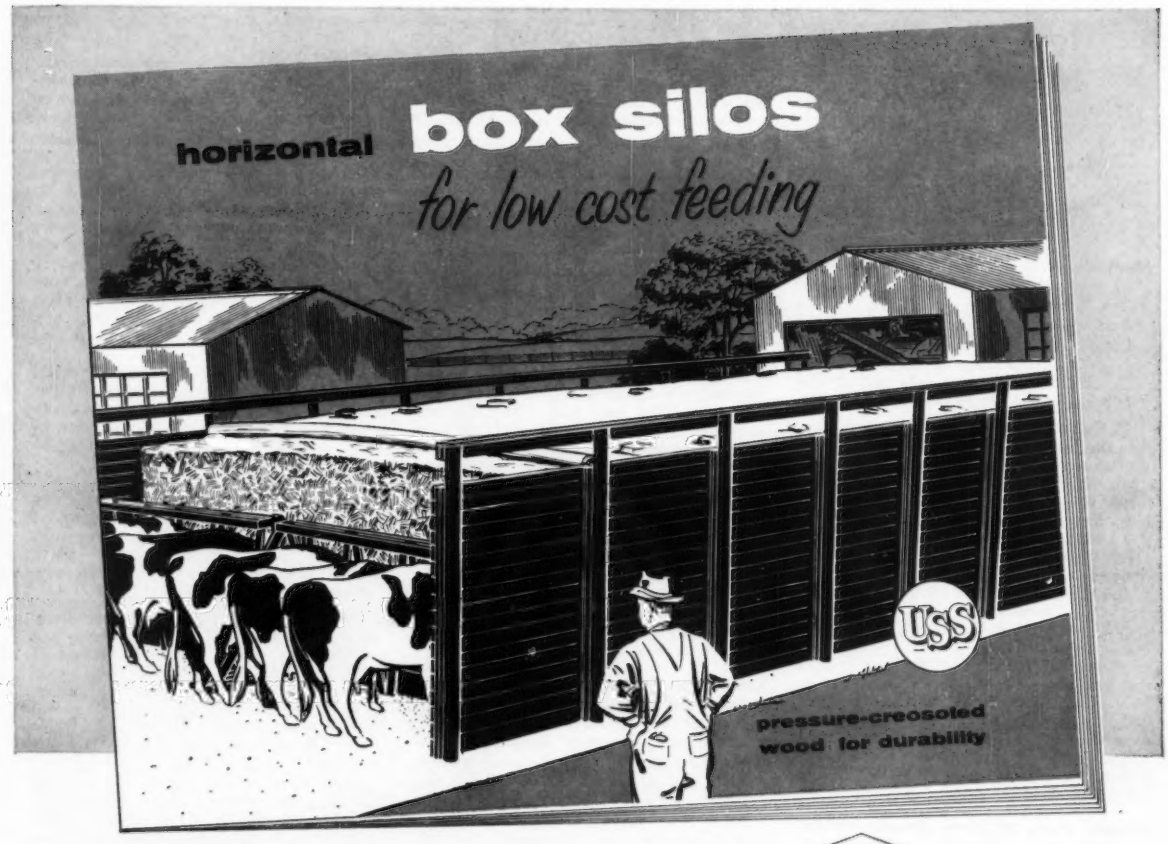
Mr. Murdock was born in 1892 at San Francisco, Calif., and graduated from the University of California in 1916. He joined ASAE in 1930 and presently was serving as chairman of the committee on exhibits for the 51st Annual Meeting. He was a past-president of the San Francisco Kiwanis Club, member of the Commonwealth Club of California, the Commercial Club, and Kappa Sigma fraternity. He is survived by his wife.

Burwell N. Kilbourn, chief engineer, Dempster Mill Mfg. Co., Beatrice, Nebr., died recently at his home after a long illness. He was first stricken last fall and had been able to work only intermittently since then.

He was born at Pueblo, Colo., in 1891. He graduated from the Colorado School of Mines in 1913 as a metallurgical and mining engineer. From 1914 to 1929 he had worked for the American Smelting and Refining Co. in Murray, Utah, and Omaha, Nebr. After 1929 he was employed by several Omaha investment firms. He left that line of work to become an analyst for the War Production Board for several months before joining the Dempster Mill Mfg. Co. as superintendent of the wartime shell plant in 1942. After the war, Mr. Kilbourn became head of the engineering department, a position he held until his death.

Among the engineering developments at Dempster he supervised were the anhydrous ammonia liquid and later the dry applicators, improvements in the furrow seeding machine and several additions to the pump line.

He was a former deacon and trustee of the First Presbyterian Church, past-president of the Rotary Club, a Scottish Rite and York Rite Mason, member of the Blue Valley Shrine Club and the Elks Club, the Colorado Mining Assn., and the Photographers Assn. of America.



With this free booklet you can show farmers

how to build box silos

Labor Costs Are Cut! This free booklet shows farmers how to build horizontal box silos themselves and cut their labor costs practically in half. It shows farmers what size silo they need for their particular herd; gives them step-by-step construction details; tells them how to fill and pack the silo.

Cattle Feed Themselves! This booklet explains to farmers how cattle can feed themselves . . . how feed can be held over from good years to dry years.

Pressure-Creosoted Lumber! You can help farmers by advising them to build their silos with pressure-creosoted posts and lumber. By using this *protected* wood, their silos will remain sound and strong for decades.

UNITED STATES STEEL CREOSOTE

Agricultural Extension
United States Steel Corporation
525 William Penn Place
Pittsburgh 30, Pennsylvania

Please send me a free supply of booklets on building horizontal box silos.

Name .....

Address .....

City ..... **State**.....

UNITED STATES STEEL

For more facts circle No. 65 on reply card

Following are brief reviews of papers presented at ASAE meetings or other agricultural engineering papers of which complete copies are available. Information concerning copies of these papers may be obtained by writing to the American Society of Agricultural Engineers, St. Joseph, Mich.

Methods of Determining Soil Moisture, by R. H. Haise, ARS, USDA, Fort Collins, Colo. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a special program arranged by the Soil and Water Division for Public Lands and Public Works. Paper No. **PL-19.**

Various methods for measuring soil moisture are discussed with respect to advantages, limitations and practical applications. Particular emphasis is given to use of tensiometers and plaster of paris blocks because these instruments are commercially available and are gaining favor among irrigation farmers to indicate when certain crops should be irrigated. Specific case histories are cited where these instruments are being used successfully to conserve irrigation water and increase crop production through better water management practices. Recent developments of automatic controls for sprinkler systems that will turn water off and on according to soil moisture needs are discussed. Application of this equipment is restricted at the present time to home lawns, cemeteries, school yards and specialty crops where permanent sprinkler irrigation systems are installed.

Present Aims of Farm Machinery Research and Testing in Sweden, by Nils Berglund, director, Swedish Institute of Agricultural Engineering, Uppsala, Sweden. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Power and Machinery Division. Paper No. **57-103.**

Sweden is reported to have become a most highly mechanized country, because of the emigration from farming to industry and other occupations. With the decrease in farmers, machines have increased. The Swedish Institute of Agricultural Engineering at Uppsala carries on the major part of the farm machinery research which is sponsored by the government. Sweden has a short growing season and many rainy days during the summer and fall, thus attention is focused upon the harvesting problems. Hay is the biggest crop and great efforts are made to mechanize the haymaking. Also progress has been made in mechanizing the potato harvest and sugar beet growing. The Swedish Institute of Agricultural Engineering is working on machinery problems such as farm wagons, braking equipment, mechanical draintile installation, engine power utilized vs. fuel consumption during different tractor operations, effect of tractor on working depth of mounted plow and effect of plow on slippage of tractor.

Sweden has an official institute for testing farm machinery and tractors. Official testing is voluntary. However, since farmers usually ask for test reports before buying a machine the manufacturer or importer generally enters a machine for testing before selling it on a large scale. A test includes both laboratory tests and tests under practical farm conditions. The paper presents a comprehensive report on the status of farm machinery in Sweden.

Backwater Caused by Bridges, by Joseph N. Bradley, Hydraulic Research Division, Bureau of Public Roads, Washington, D.C. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a special program arranged by the Soil and Water Division for Public Lands and Public Works. Paper No. **PL-6.**

The general concept that bridge design is a highly developed technical science is justified only so far as the superstructure is concerned. The waterway, which involves numerous variables, is reported to have lagged far behind the rapid advances in superstructure design. Efforts on the part of the U. S. Bureau of Public Roads to place waterway design on a sounder footing through recent hydraulic research programs utilizing models and field structures is explained. The paper includes a description of the research projects, a brief examination of the more important experimental results to date, and discussion of the influence of these findings on present thinking regarding bridge waterway design.

Evaluation of Some Major Factors in the Soil Loss Equation, by W. H. Wischmeier, D. D. Smith, and R. E. Uhland, respectively, analytical statistician, agricultural engineer, and soil conservationist, ARS, USDA, Beltsville, Md. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Soil and Water Division on Erosion Control. Paper No. **57-90.**

An underlying feature in determining soil conservation measures to be applied to farm lands is soil loss estimation from variables whose value is known or can be determined for a specific field or locality. Recent developments are presented which add materially to information available to serve as a basis for factors comprising the soil-loss estimating equation.

Various rainstorm characteristics are evaluated as soil-loss estimators. A table of kinetic energies per inch of rain falling at 0.01 to 10.0 in per hr is presented to simplify the use of rainfall energy to predict soil loss. A single rainstorm-characteristic which appears to be outstanding for storm classification with respect to erosion potential is pointed out.

Control of Cattail and Other Vegetation in Drainage Ditches, by W. A. Cutler and B. H. Grigsby, respectively, extension agricultural engineer and professor of botany and plant pathology, Michigan State University, East Lansing. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Soil and Water Division. Paper No. **57-86.**

This paper reports on experimental work completed in Michigan on the eradication of cattail and other woody and herbaceous growth encountered on drainage ditch banks and in ditch bottoms. Drainage engineers have been concerned with finding economical methods of eliminating excess vegetative growth in drainage ditches and at the same time establishing native grasses on the ditch banks to control erosion, and thereby increase the period between expensive clean-outs.

The problem of keeping drainage ditches free from undesirable growth was alleviated considerably by the introduction of growth regulator herbicides, however, these materials have very little effect on cattails. New herbicides which show considerable effect on cattail as well as on grasses have provided a means for immediate control and eventual eradication.

The authors discuss the effect of excess herbaceous and woody growth on the velocity of flow in drainage ditches, the materials and methods used for eradication of cattail and the results obtained on the experimental plots.

Development in Low-Cost Subsurface Drainage, by C. D. Busch, agricultural engineer, ARS, USDA. Paper presented at the North Atlantic Section ASAE Meeting at the University of Delaware, August, 1957. Paper No. **57-38.**

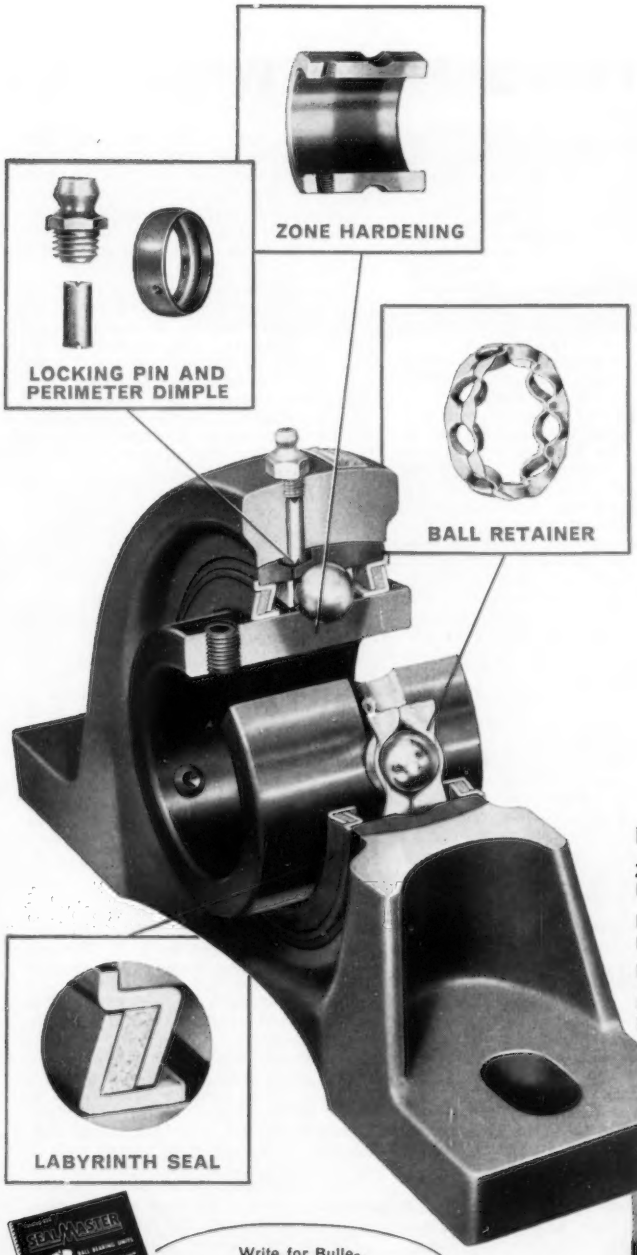
This paper reports on cooperative drainage research between Cornell University and the Soil and Water Research Division of ARS, USDA. This study has been undertaken to develop a low-cost subsurface drain. The need for such a drain, as well as the potential for achieving it, is given briefly. A short review of other attempts to perfect a low-cost drain is included.

The author reports the current work at Cornell in two phases. The first phase is a field investigation to determine the causes of failure in the lowest cost subsurface drain—the mole drain. Top soil falling through the mole blade slit and the slit's closure under load are found to be important factors as well as the natural biologic activity in the soil. The second phase deals with the design and preliminary testing of an arch-shaped mole channel lining machine. The lining is said to be formed from a 0.015-in thick by 6-in wide plastic strip which is fed into the ground as the machine moves forward. Preliminary tests in a replicated experiment indicate the lined channels to be in better condition than the unlined channels after one season's use. The appliciation potential of the lined channel and plans for future improvements are also mentioned.

The Handling and Drying of High Moisture Chopped Hay, by W. L. Kjelgaard, assistant professor of agricultural engineering, Pennsylvania State University. Paper presented at the North Atlantic Section Meeting of ASAE at the University of Delaware. Paper No. **57-39.**

Four years of research and testing at the Pennsylvania Agricultural Experiment Station has produced the tiered air duct mow drying system that possesses two outstanding characteristics as explained in this paper: the system is flexible and can easily be adapted to a wide range of hay storage depths and mow loading schedules, and the air flow is controlled during the drying period and can be adjusted to penetrate the mow area where it is most needed.

The tiered duct system is described as the building of one central duct on top of another. The ducts were made in portable sections by rolling flat sheets of 6 x 8-ft expanded metal and adding vertical supports. Three tiers of ducts were required for a hay depth of about 20 ft.



THIS EXCLUSIVE COMBINATION OF FEATURES IS YOURS WITH SEALMASTER BALL BEARING UNITS ... PLUS QUICK, EASY MOUNTING!

Slip a SEALMASTER Ball Bearing Unit into place on the shaft—tighten two set screws and you have the answer to ease of mounting in a bearing unit. SEALMASTER'S exclusive combination of features take over from there, providing smooth, trouble-free performance and long bearing life.

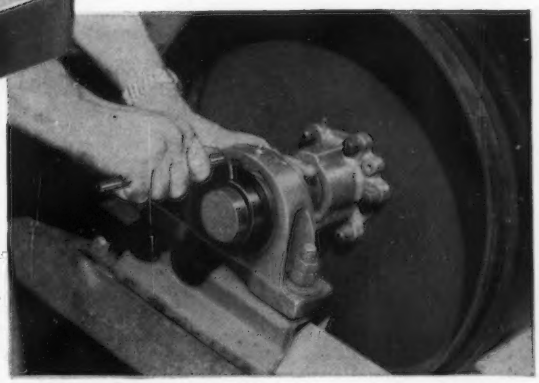
FEATURES:

ZONE HARDENING . . . assures positive race-to-shaft holding power.

LAND RIDDEN BALL RETAINER . . . traps grease and prevents "churning."

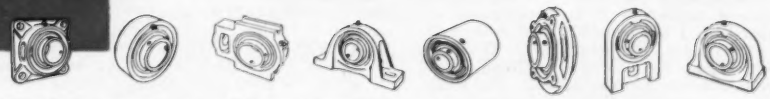
LABYRINTH SEAL . . . keeps dust and dirt out, lubricant in.

LOCKING PIN & PERIMETER DIMPLE . . . assures positive lubrication.



Write for Bulletin 454 for full information.

SEALMASTER®
BALL BEARING UNITS



SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. 67 RIDGEWAY AVENUE, AURORA, ILL.

For more facts circle No. 66 on reply card

WINTER MEETING PREVIEW

The 1957 winter meeting of the American Society of Agricultural Engineers will be held December 15-18 at the Edgewater Beach Hotel, Chicago, Ill. The executive committees of the Society's four technical divisions — Power and Machinery, Soil and Water, Farm Structures and Electric Power and Processing—presently are in the process of completing arrangements with prospective speakers for what promises to be a most interesting and informative program.

Advance registration cards and hotel reservation forms will be received by ASAE members shortly. Non-members interested in attending the meeting should communicate with the central office of the Society at St. Joseph, Mich., for information on accommodations and the program of the meeting sessions.

Highlights of the program are as follows:

Power and Machinery Program

The presiding chairman of the first session of the Power and Machinery Division on Monday morning, December 16, will be C. B. Richey, vice-chairman of the Division. The program will open with a paper on ball bearing design trends for farm machinery, by R. S. Howe, Jr. and G. H. Raley, respectively, application engineer and engineering manager, The Fafnir Bearing Co. Other discussions will be on overrunning and torque limiter clutches, by P. W. Vinton, manager, Clutch and Coupling Dept., Morse Chain Co.; finite life gear design for agricultural equipment, by H. A. McAninch, vice-president, engineering, Warner Automotive Parts Division; and fewer-better lubricants for agricultural equipment, by C. N. Hinkle, agricultural engineer, Standard Oil Co.

During the Monday afternoon session a symposium on the what, how, and why of tandem tractors will be presented by W. F. Buchele, Michigan State University; E. V. Collins, Iowa State College; C. B. Richey, Tractor & Implement Div., Ford Motor Co.; J. A. Garman, Caterpillar Tractor Co.; and L. E. Lawson, Green Giant Co. A paper on the effects of two-wheel and tandem drives on traction and soil compaction, by I. F. Reed, C. A. Reaves, and A. W. Cooper, National Tillage Machinery Laboratory, will also be discussed.

C. S Morrison, chairman, Power and Machinery Division, will preside at the meeting Tuesday morning, December 17. The theme of the program will be on ergonomics in farm equipment operation. Wayne Worthington, John Deere Research and Engineering Center, will present a translation of the paper on human stresses and farm tractors, by H. Dupuis, Max-Planck Institute for Farm Work and Agricultural Engineering, German Federal Republic. Other topics to be discussed will be heat stresses in tractor operation, by W. H. M. Morris, J. B. Liljedahl, and J. Wiebers, Purdue University; physiological costs of driving farm tractors, by J. Wiebers and G. Beals, respectively, Purdue University and the U.S. Army; steering forces of farm tractors, by J. B. Liljedahl, R. Gluck, and M. Schroeder, respectively, Purdue University, United States Rubber Co., and Pennsylvania State University; and the application of psychology to farm equipment design, by E. J. McCormick, Purdue University.

Wednesday, December 18, L. G. Kopp, junior past-chairman of the Division, will preside at the morning session. The theme of the program will be on harvesting research, and will include the following papers: "Machine and Method Efficiency in Combining Wheat," by W. H. Johnson, Ohio State University; "Performance Characteristics of the Grain Combine in Barley," by J. R. Goss and R. A. Kepner, University of California, Davis; "Seed Harvesting Research in Oregon," by J. E. Harmond, ARS, Oregon State College; "Seed Harvesting Research in the Southeast," by J. K. Park, ARS, Clemson Agricultural College; and "Grape Harvester Research," by L. H. Lamouria, A. J. Winkler, and C. R. Kaupke, University of California, and G. H. Abernathy, New Mexico A & M College.

The vice-chairman of the Power and Machinery Division, C. B. Richey, is to preside during the Wednesday afternoon meeting. M. W. Forth and C. S. Morrison, Deere & Co., will discuss a paper on one-man baled hay harvesting; Kurt Hain, Institute for Agricultural Research, Braunschweig, German Federal Republic, is to present a paper on controlling the depth of hitch-mounted plows over uneven ground; B. A. Stout, Michigan State University, will give a paper on effect of soil compaction on emergence of sugar beet seedlings; and H. D. Wittmuss and L. W. Hurlbut, University of Nebraska, will discuss minimizing cultural operations in corn and milo production.

Soil and Water Program

The Soil and Water Division has planned a program featuring a half-day session for each of its four groups and a half-day general session of the Division.

Irrigation Group — E. H. Kidder, chairman, will conduct the program for this group, Monday morning, December 16. The following topics will be covered: "Energy of Falling Drops from Medium Pressure Sprinklers," by Paul E. Schleusener and E. H. Kidder, respectively, University of Nebraska and Michigan State University; "Performance Studies on Giant Type Irrigation Sprinklers," by D. J. Brosz and J. L. Wiersma, South Dakota State College; "Mosquito Reduction by Agriculture," by Sterling Davis, ARS, Chinook, Mont.; "Built-up Asphalt Linings for Irrigation Canals and Reservoirs," by C. W. Lauritzen, ARS, Logan, Utah; and "Mechanized Soil Sampler with Offset Drive," by M. E. Jensen, W. H. Sletten and R. L. Ochs, SWCRD, ARS, Southern Great Plains Field Station, Bushland, Texas.

Hydrology Group—The vice-chairman of the group, E. C. Buie, will preside during this session on Monday afternoon. Papers on the design and performance of earth spillways, by P. M. Price, SCS, Temple, Texas; selecting the water year applicable to small agricultural watersheds, by D. L. Brakensiek, ARS, Coshocton, Ohio; selected intense storms in Little Sioux River subwatersheds, by H. P. Johnson and R. K. Frevert, respectively, Iowa State College and Iowa Agricultural Experiment Station; and a method of determining average watershed precipitation, by V. I. Myers, ARS, Reno, Nev., will be covered during this program.

Erosion Control Group — Tuesday morning, December 17, chairman Dwight D. Smith will preside over the meeting for this group. The program will open with a discussion on conservation benches, by Austin W. Zingg, Watershed Technology Research Branch, ARS, Beltsville, Md. L. D. Worley, SCS, Athens, Ga.; L. D. Meyers, ARS Purdue University; and N. P. Woodruff, Kansas State College; will also present topics for discussion on, respectively, land smoothing for improved terrace alignment, development and use of a rainfall simulator, and influence of tillage on factors affecting wind erosion.

Drainage Group — The program of the Drainage Group will be directed by the chairman, J. W. Borden, Wednesday morning, December 18. The meeting will include papers on drainage research in Colorado, by N. A. Evans and A. R. Robinson, respectively, Colorado State University, and ARS, Fort Collins, Colo.; underseepage control for levees, by H. A. Sikso, U.S. Army Engineer District; the falling water table in tile drainage and factors affecting the rate of fall, by J. N. Luthin and R. V. Worstell, University of California, Davis; and engineering procedures and costs of land forming for eastern Virginia, by Phelps Walker and J. H. Lillard, Virginia Polytechnic Institute.

Wednesday afternoon, December 18, a meeting is scheduled for the Soil and Water Division which will include the four groups. The chairman of the Division, K. H. Beauchamp, will open the session. Papers to be presented will include "Trends in Pond Water Use and Treatment," by E. R. Baumann and T. L. Willrich, Iowa State College; "Bench Leveling for Irrigation and Erosion Control," by J. T. Phelan, SCS, Lincoln, Nebr.; "Land Leveling for Drainage and Irrigation," by R. L. Phillips, SCS, Council Bluffs, Iowa; and "Diversion Terraces for Erosion Control and Drainage," by F. R. Brower, Jr., SCS, Harrisburg, Pa.

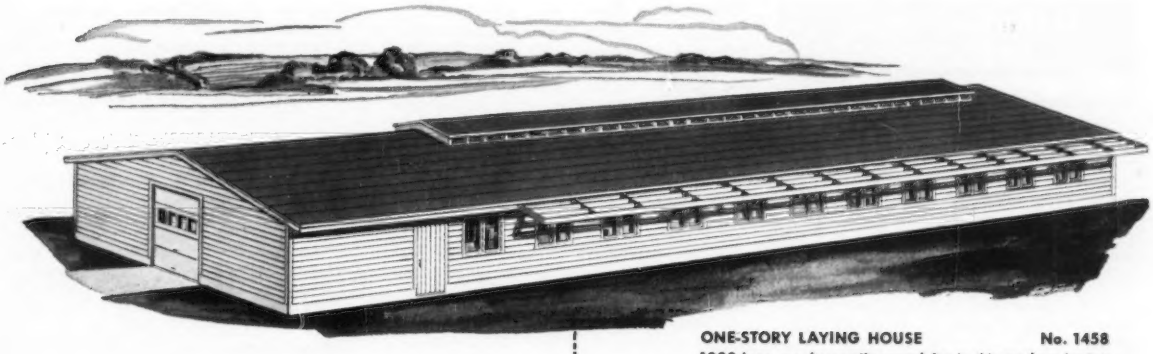
Farm Structures Program

The opening session of the Farm Structures Division, Monday morning, December 16, will be conducted by S. S. DeForest, vice-chairman. The theme of the program is pre-engineered systems, buildings and equipment. W. H. Yaw, Farm Clinic, West Lafayette, Ind., will present a paper on some suggestions for combining engineering, marketing and management in successful farming; J. D. Sykes, Ralston Purina Co., will discuss contract farming and its effect on buildings; R. M. Cleveland, Farmer Feeder Co., Cambridge City, Ind., will talk on the subject of how to milk 60 cows per hour with the herringbone system; and F. P. Stephan, James Mfg. Co., Fort Atkinson, Wis., is to speak about a packaged laying house for the poultry industry.

During the Monday afternoon meeting, Merle L. Esmay, chairman of the Farm Structures Division will preside and the theme is to be on farm building and equipment design specifications. Speakers will be H. J. Barre, consulting agricultural engineer; Norval Curry, Iowa State College; J. S. Boyd, Michigan State University; R. E. Eby, Rilco Laminated Products, Inc.; and J. O. Blew, Jr., USDA Forest Service, Madison, Wis. They will present papers, respectively, on developing structural requirements for farm building design, farm buildings design standards, farm fence specifications, design criterion for glued laminated wood, and preservative treatment of wood for farm uses.

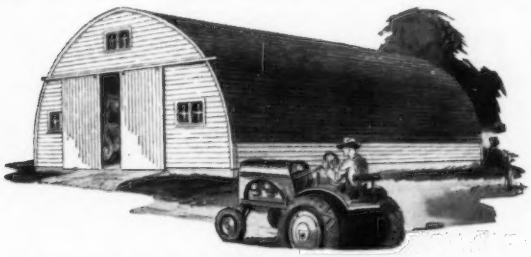
A joint session with the Electric Power and Processing Division is scheduled for Tuesday morning, December 17, with Gerald

(Continued on page 822)



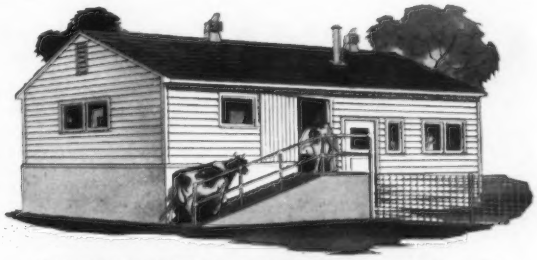
ONE-STORY LAYING HOUSE **No. 1458**

1000 hens can be easily cared for in this modern laying house. It features double-wall construction, insulated ceiling, automatic equipment, and an egg cooling room.



ARCHED ROOF MACHINERY SHED **No. 3205**

Every inch of this shed is usable space. There are no obstructing posts. The glued, laminated wood rafters save construction time, labor and materials.



MILKING PARLOR AND MILK HOUSE **No. 1005**

One man can milk 30 cows per hour in this modern, highly efficient milking parlor and milk house. The elevated milking stalls are arranged in a U-shape.

Ideas for Better Farming

FROM THE WEYERHAEUSER 4-SQUARE FARM BUILDING SERVICE

Above are illustrated three of the modern buildings in the Weyerhaeuser 4-Square Farm Building Service.

Many agricultural leaders are finding in this Service helpful, practical building ideas that assist them in their work with farmers. The Service includes scores of plans for farm buildings, lumber-built farm equipment items, and modern farm homes.

All of the buildings were structurally engineered by Weyerhaeuser engineers after working with agricultural experts as to the functional requirements of farm buildings.

If you are interested in buildings that help increase farm income and save chore time, the complete Farm Service Book is ready for your inspection and use at the yards of dealers who sell Weyerhaeuser 4-Square Lumber. For a preview, the coupon below will bring you literature illustrating and describing some of the buildings in the Service.

WEYERHAEUSER

4-SQUARE

LUMBER AND BUILDING SERVICES

***Free* BOOKS**

Mail coupon today—to help you plan new buildings that increase profits and also save chore time!

Weyerhaeuser Sales Company
P.O. Box 5000, Dept. D-117, St. Paul 4, Minnesota

• Please send me the free booklets I have checked:

☐ Modern Farm Buildings ☐ 22 Farm Homes
☐ Lumber-Built Farm Equipment

Name _____
(PLEASE PRINT)

Address _____

City _____ *State* _____

For more facts circle No. 67 on reply card

MANUFACTURERS' LITERATURE

Water Systems

Barnes Mfg. Company—A 6-page folder covering operating features and applications for farm and home water systems aids in estimating water system requirements and the selection of proper equipment for a specific application. It describes factors to be considered before an installation is made and lists essential farm and home water services, gives recommended capacities in gallons-per-day, based on number of services desired, size of the family and type of farm contemplating a new or improved water system.

(For more facts circle No. 1 on reply card)

Polyethylene Pipe

Bakelite Company — This brochure called Proved by Performance, No. 9516, describes the service provided by polyethylene pipe. Specifications for safe working pressures of standard wall pipe, adopted by the pipe industry, are also outlined.

(For more facts circle No. 2 on reply card)

Maintenance Guide

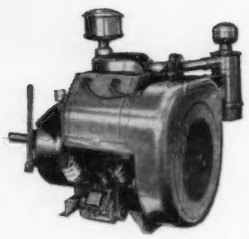
Caterpillar Tractor Co. — This 24-page booklet has color drawings of helpful hints for obtaining optimum service life from the company's equipment. Written in narrative form it tells the story of how one tractor owner learned to keep his machine on the job with lower maintenance costs. Cartoon-type drawings help point out good maintenance practices.

(For more facts circle No. 3 on reply card)

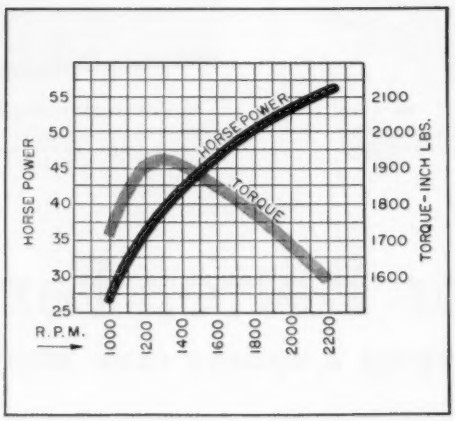
What makes *load-holding*

LUGGING POWER

in an engine?



Note the progressive, High Torque build-up as indicated on the power curve for the Model VR4D Wisconsin V-type, 4-cylinder, 56 hp. engine. Here's real load-holding Lugging Power!



Basic engineering makes the difference . . . in terms of HIGH TORQUE performance.

All Wisconsin Heavy-Duty Air-Cooled Engines are engineered and built with a HIGH TORQUE FACTOR. The resulting operating characteristics are such that the torque will *increase* under reduced engine speed. The tendency for the increasing load to slow down the engine is *resisted* with a strong "holding force" and the engine will "hang on" and make a quick power recovery under conditions that would stall most engines.

This load-holding Lugging Power is one of the important reasons why Wisconsin Engines are so well-suited to farm field service . . . service that calls for the *best* an engine can deliver. In addition, *all* Wisconsin Air-Cooled Engines are of heavy-duty design and construction in all details — including Stellite Exhaust Valves and Valve Seat Inserts . . . for long engine life and low-cost maintenance.

Dependable Air-Cooling at temperatures up to 140° F. give final assurance of "Most Hp. Hours" of rugged agricultural equipment service under your conditions.

You can't go wrong if you specify "Wisconsin Power" for your farm equipment. Write for Bulletin S-212.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

Meters for Liquid Propane, Butane

Rockwell Mfg. Co. — An 8-page bulletin OG-412 which combines descriptions of the company's liquid meters for measuring liquid propane, liquid butane and liquid propane-butane mixtures. It includes drawings to explain the dispensing system which is said to keep the product in a liquid state throughout metering.

(For more facts circle No. 4 on reply card)

Prototype to Finished Casting Catalog

Wellman Bronze and Aluminum Co. — This catalog lists physical properties and conforming specifications for magnesium and aluminum alloys. It includes alloys for sand castings, permanent mold and rare earth alloys.

(For more facts circle No. 5 on reply card)

Engines in Action

Kohler Company—An illustrated 28-page catalog which contains descriptions and specifications of models and variations in the company's line of engines. It also includes illustrations of applications of various models, such as lawn and garden equipment, snow removers, concrete vibrators, pavement rollers, and other types of equipment.

(For more facts cirle No. 6 on reply card)

Multi-Wall Foil Bags

Reynolds Metals Co.—A brochure describing aluminum foil-lined bags which are offered as a replacement for steel drums in the bulk shipping of many industrial and chemical products. It is pointed out that the Reynolds Metals Co. does not manufacture the bags, but supplies aluminum foil to manufacturers of the new bag.

(For more facts circle No. 7 on reply card)

Rugged Castings for Rugged Road Builders

Racine Steel Castings Co.—Folder No. 16 is intended to be a time exposition of the place that steel castings will hold in the manufacture of the principal kinds of road building machines. Examples of steel castings for typical road building machines are shown along with details of the process by which they are made.

(For more facts circle No. 8 on reply card)

Slide Chart

Enjay Company, Inc. — A slide chart that aids in the selection of filler materials to be used with Enjay Butyl. It shows the combination of properties that are obtained with the use of 17 reinforcing and non-reinforcing filler materials, and two different grades of Enjay Butyl.

(For more facts circle No. 9 on reply card)

Ball Bearings for Farm Implements

New Departure Division of General Motors Corp.—This 19-page booklet illustrates and describes different types of ball bearings the company manufactures for farm implements. Charts on dimensions and load ratings are also included.

(For more facts circle No. 10 on reply card)

Savings Stories

Tinnerman Products, Inc. — This booklet Vol. 7 contains a series of case histories reporting cost reductions provided by the company's Speed Nuts. It describes and illustrates fastening applications.

(For more facts circle No. 11 on reply card)

Ratios in Metal Industries

Dun & Bradstreet, Inc. — A study which presents 14 important ratios for 11 manufacturing lines in the metal industries. An explanation of terms is also included.

(For more facts circle No. 12 on reply card)

New Holland's rugged 100-bushel spreader saves trips between barn and field

Bigger loads mean more economical spreading

TIME, more than ever before, is coming to be recognized as a critical factor in farm economics. Every minute that can be saved through the use of fast-working machines or by the adoption of time-saving materials-handling methods helps lower costs or raise production.

In the matter of manure spreading, for example, farmers are finding they can cover more ground faster by replacing their 60- or 70-bushel spreaders with models that can carry a full 100-bushel load. A properly designed 100-bushel spreader pulls and maneuvers easily. Because of its bigger load, it saves trips between feedlot and field. The farmer gets his spreading jobs done sooner, and gains time to do other vital work.

The New Holland 100-bushel spreader is built low to make loading easier, whether by hand or with power equipment. Only 42 inches high, it can be run directly under barn cleaners or mechanical loaders. It is available in either ground drive or P.T.O. models.

For larger farms, the New Holland 130-bushel spreader offers even greater economies. It cuts trips to far fields by half. It becomes a year-round 3-in-one machine with the addition of optional forage sides and cross-conveyor attachment, which convert it into a self-unloading wagon and automatic bunk feeder. If you think you'd like to be a New Holland engineer and want to know more about us, please write New Holland Machine Company, New Holland, Pennsylvania.

NEW HOLLAND

"First in Grassland Farming"

For more facts circle No. 70 on reply card

. . . Meeting Preview

(Continued from page 818)

Isaacs, presiding. Subjects to be discussed will cover grain drying with solar heat, by Fred Buelow, Michigan State University; air distribution pattern from lateral ducts in grain storage structures, by D. B. Brooker, University of Missouri; converting present ear corn storage to shelled corn storage, by Duane Dahnert, Waterman Electric Co.; air-meter, a product of conducting research on grain ventilation, by Tappan Collins, Stran-Steel Corp.; and accuracy and limitations of automatic controls for crop drying, by H. A. Cloud, Minneapolis-Honeywell Co.

L. L. Boyd will preside at the Wednesday morning, December 18, session. The theme will be on the standardization and prefabrication of building units. Talks on the development of an all-steel farm building for basic shelter, by J. Dewey Long, Stran-Steel Corp.; a new light-weight trussed rafter, by G. L. Nelson, G. W. A. Mahoney, and J. I. Fryrear, Oklahoma State University; cable and single slope wood truss design, by Merle L. Esmay, Michigan State University; testing and evaluating forces on full-scale building sections, by J. P. H. Mason, Jr., Virginia Polytechnic Institute; and trussed-frames for pole buildings, by W. H. Friday, A. C. Dale, R. H. Perkins and S. K. Suddarth, Purdue University, are to be given.

A symposium on farm buildings plan services will be presented during the Wednesday afternoon program of the Farm Structures Division. Topics to be discussed are about the USDA farm buildings plan service, by Wallace Ashby, AERD, ARS, Beltsville, Md.; the Midwest plan service, by J. H. Pedersen, Iowa State College; the Western plan exchange, by L. W. Bonnickson, Oregon State College; state plan service, by R. L. Maddex, Michigan State University; and the Kaiser plan service, by G. T. Facer, Kaiser Aluminum and Chemical Sales Co.

Electric Power and Processing Program

The theme of the Monday morning, December 16, electric power and processing program will be on instrumentation and quality control, with W. G. Buchinger, chairman, presiding. Papers will be presented on instrumentation to measure light transmittance properties of agricultural commodities, by K. H. Norris, USDA, Beltsville, Md.; cage poultry house operation, by Leonard Graham, Innes Co.; maintaining quality of high moisture grain in airtight storages, by G. W. Isaacs, Purdue University; a low-cost crop moisture tester, by B. C. Haynes, Jr., USDA, Athens, Ga.; and ground feed particles distribution, by R. C. Nicholas and C. W. Hall, Michigan State University.

Dean L. Searls will preside at the Monday afternoon meeting and the theme will be feed handling. Subjects to be covered will be on efficiency of materials handling methods and labor requirements, by R. W. Kleis and D. E. Wiant, respectively, University of Massachusetts and Michigan State University; feed handling systems analysis, by Ira J. Ross, Purdue University; and power requirements and capacities of auger elevators, by W. F. Millier and Gerald Rehkugler, Cornell University. To close the session a panel discussion is scheduled to be presented on feed handling equipment components.

A joint meeting with the Farm Structures Division is planned for Tuesday morning, December 16 (see outline of program under Farm Structures Program).

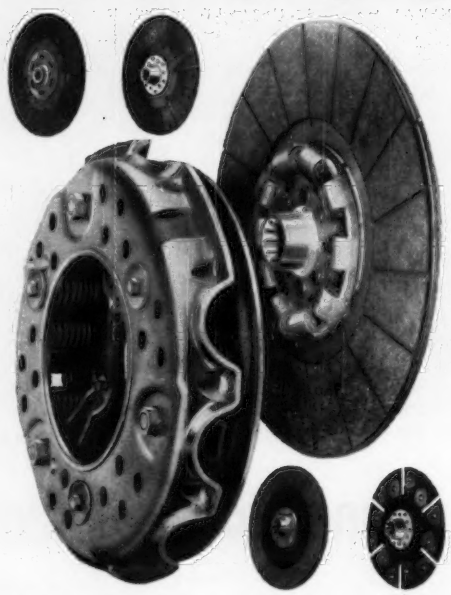
K. L. McFate will direct the session for Wednesday morning, December 18. The program will include talks on a practical approach to the farm wiring problem, by H. C. Grube, Northwestern Rural Electric Co-op; design requirements for underfloor heat brooding of pigs, by John Taylor and E. A. Johnson, Purdue University; criteria for proper water pump selection, by G. E. Trisler, The Deming Co.; our experience with 20-hp single-phase motors, by R. S. Crist, West Pennsylvania Power Co.; and experiences with pneumatic farm structures, by L. W. McConnell.

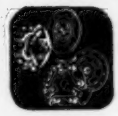
The afternoon meeting will be presided over by W. G. Buchinger, chairman of the Division. Papers are scheduled to be presented on biological activity in grain drying, hay in a day, poultry house cooling, low-cost quality hay, and selling 100 and 200-amp services to farmers via field trips and demonstrations. The authors of these papers are, respectively, R. A. Saul and Frode Lind, J. B. Stere, R. C. Jaska, C. A. Weaver, and Owen Fordham.

General Program

A general program is scheduled to be held Tuesday afternoon, December 17. June Roberts, chairman of the Education and Research Division, will preside during the session. The first speaker will be the Honorable George D. Clyde, Governor of the State of Utah, who will discuss reclamation and the agricultural surplus. Glenn Murphy of Iowa State College will speak on the applications of similitude theory to agricultural engineering research, and Henry E. Bent from the University of Missouri will report on fundamental research — pinnacle or foundation.

ROCKFORD





Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

A Clutch Plate—for Every Use

ROCKFORD CLUTCHES are made with a wide variety of friction plates—to meet your specific needs exactly. Organic, metallic, segment or Morlife® cerametalic facings provide the right torque, wear and heat resistance characteristics. Cushioning arrangements minimize the effects of shock-load engagements. Dampeners blot out vibration and chatter. Pressure plates of high tensile strength resist centrifugal force of modern high speed engines. These ROCKFORD advantages will help you select the *right* friction clutch for your particular needs.

BW **SEND FOR THIS HANDY BULLETIN** Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER

1325 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

For more facts circle No. 84 on reply card

WHERE POWER STEERING REALLY COUNTS

—making the job easier for the man who rides a tractor

Power steering is every bit as desirable for farm tractors as it is for passenger cars—*and for more and better reasons.*

By taking the tiresome muscle work out of steering, it makes tractor work not only an easier task but a far more efficient operation.

For example, power steering eliminates wheel fight and shock even over the roughest ground; it permits the tractor to be controlled by simply "pointing" where the driver wants it to go.

Also, short turns become an easy, one-hand job even when the tractor is standing still.

Any way you look at it, power steering saves time as well as work, and that's exactly why power steering on farm tractors is destined to be the next step forward in farming efficiency.

Bendix* Power Steering is a performance-proven product designed and engineered by Bendix, foremost producer of power steering and brakes for the automotive industry.

It is used with a conventional steering gear and is adaptable to existing steering linkage, permitting tractor manufacturers to make production-line installations without costly or extensive engineering changes.

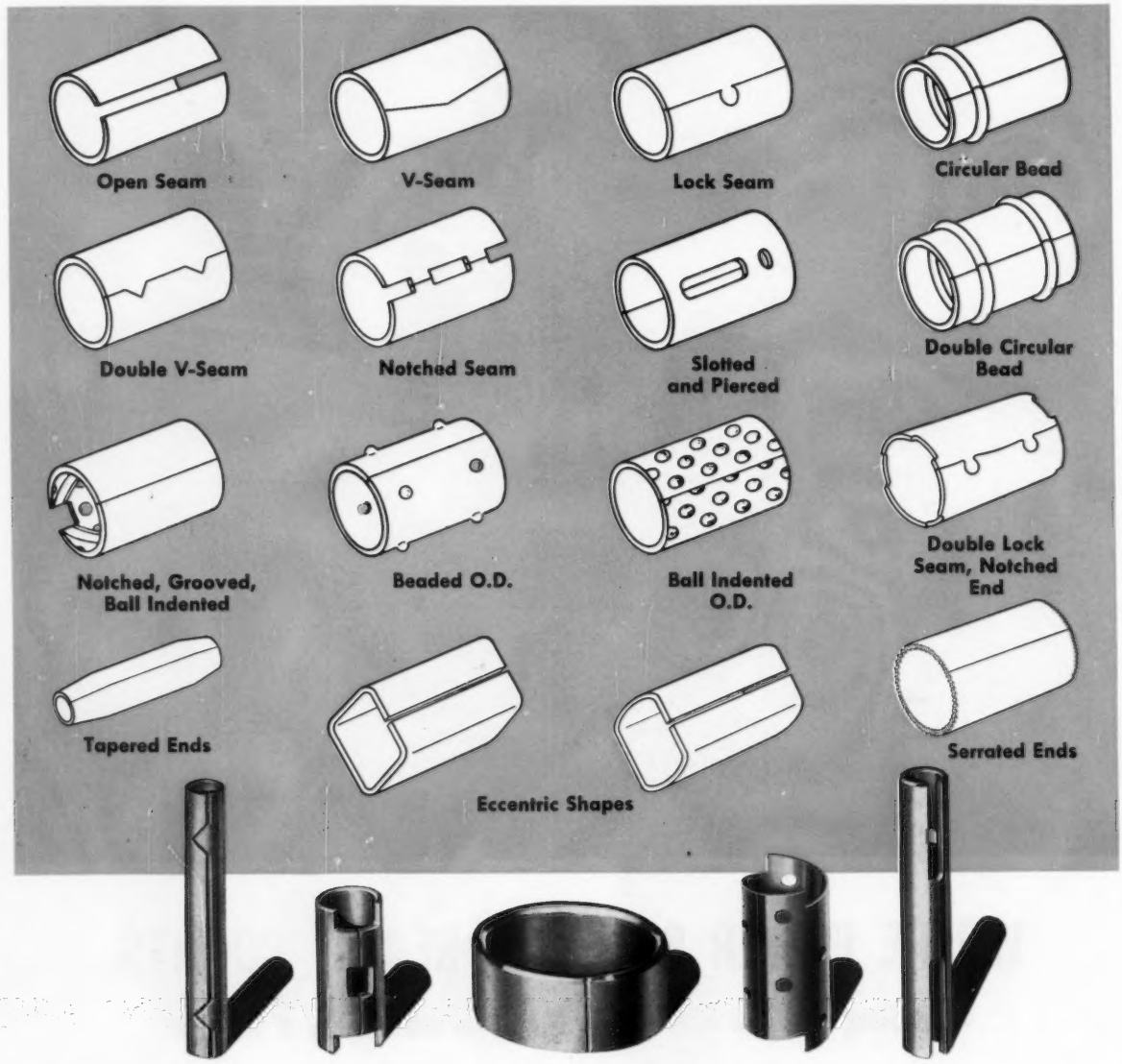
Manufacturers interested in adding Bendix Power Steering to their present list of sales features are invited to write for further details to BENDIX PRODUCTS DIVISION, SOUTH BEND, INDIANA. *REG. U.S. PAT. OFF.

Export Sales and Service:
Bendix International Division
205 East 42nd Street, New York 17, N. Y.

Bendix PRODUCTS DIVISION South Bend, IND.

Bendix AVIATION CORPORATION

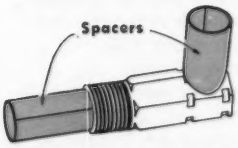
For more facts circle No. 59 on reply card



Rolled Split Steel Spacer Tubes in Great Variety and at Low Cost

Used in hundreds of automotive, appliance, farm implement and wheeled goods assemblies, they save time, labor and costly materials. An economical substitute for iron pipe, tubing or machined parts, they are delivered ready for assembly, to exact dimensions. A special catalog with design data is available, without obligation. Address:

FEDERAL Mogul SINCE 1899



Spacers can be furnished with brazed seams and we can braze spacers to other components, as shown here.

FEDERAL-MOGUL DIVISION

FEDERAL-MOGUL-BOWER BEARINGS, INC., 11081 SHOEMAKER, DETROIT 13, MICHIGAN

RESEARCH • DESIGN • METALLURGY • PRECISION MANUFACTURING

Solve Your Gift Problems

Give something of lasting value, something to inspire and improve, something that will stand out as *YOUR* thoughtful remembrance. GIVE A SUBSCRIPTION TO AGRICULTURAL ENGINEERING to your farmer friends, to your favorite library, to executives interested in engineering or agriculture. Mail the card at the right to place your order. Subscriptions are $5.00 in the USA, $5.50 in Canada, $6.00 elsewhere. ASAE will send a letter to your honoree, in accordance with your instructions, giving details regarding his gift and the name of the donor.

CHECK

GIFT SUBSCRIPTION TO AGRICULTURAL ENGINEERING

☐ I would like to send a GIFT subscription to AGRICULTURAL ENGINEERING to the person indicated below. I would like the subscription to begin with the_____issue.

Please write the recipient for me advising that this is a Christmas_____, Birthday_____, other_____ gift. ($5.00 in USA; $5.50 in Canada; $6.00 elsewhere).

My name is_____

Payment enclosed_____ Please invoice me_____

☐ I am an ASAE member and suggest that membership, including application form be sent to the name and address below.

My name is_____

☐ I would like information about membership in the American Society of Agricultural Engineers including an application form.

Name_____

Position or title_____

Address (☐ **Home or** ☐ **Business**)_____

City_____ **Zone**_____ **State**_____

Employed by_____

Use the card *below* for free data on new products and the card *above* for ordering a gift subscription to AGRICULTURAL ENGINEERING or for requesting information about membership in ASAE.

LET US KNOW YOUR WANTS

Kindly have mailed to me, without obligation, more information about items in this issue indicated by the numbers circled below:

NOVEMBER 1957

→ *Please print or type your name, etc., below* ←

Your name_____

Your position or title_____

Name of employer_____

Address of employer_____

City_____ Zone_____ State_____

New Products, New Catalogs, and Advertisements in AGRICULTURAL ENGINEERING

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Do you want more data or other information on products or catalogs advertised or otherwise featured in this issue? Then fill out one of the two mailing cards at the right and drop it in the mail today.

Our "Reader Information Service" clerks will see that your wants are promptly transmitted to sources of materials requested.

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 1 **St. Joseph, Mich.**

AGRICULTURAL ENGINEERING
P. O. Box 229
St. Joseph, Michigan

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 1 St. Joseph, Mich.

American Society of Agricultural Engineers
P.O. Box 229
St. Joseph, Michigan

If you are not a member of the American Society of Agricultural Engineers and want (1) to subscribe* to AGRICULTURAL ENGINEERING or (2) to receive information about ASAE membership—or if you *are* a member of ASAE and want to propose the names of one or more prospective members — then simply fill out and mail the card at the left.

(*NOTE: A subscription to AGRICULTURAL ENGINEERING is included in the annual dues of each ASAE member.)

Use the card *below* for free data on new products and the card *above* for subscribing to AGRICULTURAL ENGINEERING, or for requesting information about membership in the ASAE.

LET US KNOW YOUR WANTS

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 1 St. Joseph, Mich.

AGRICULTURAL ENGINEERING
P.O. Box 229
St. Joseph, Michigan

Reader Information Service

Kindly have mailed to me, without obligation, more information about items in this issue indicated by the numbers circled below: **NOVEMBER 1957**

→ *Please print or type your name, etc., below* ←

Your name_____

Your position or title_____

Name of employer_____

Address of employer_____

City_____ Zone_____ State_____

New Products, New Catalogs, and Advertisements in AGRICULTURAL ENGINEERING

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99

Do you want more data or other information on products or catalogs advertised or otherwise featured in this issue? Then fill out one of the two mailing cards at the left and drop it in the mail today.

Our "Reader Information Service" clerks will see that your wants are promptly transmitted to sources of materials requested.

The good name of your machine is LINK-BELT's first consideration . . . TRADE MARK . . . and quality should be your first consideration in the chain you buy

McCormick No. 163 self-propelled windrower uses Link-Belt roller chain and sprockets and flexible couplings.

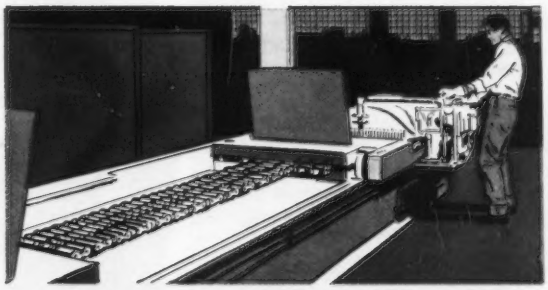
Be sure you specify drive and conveyor chain with

the quality your design deserves

Use LINK-BELT chain . . . built to top farm machine standards as determined by field and lab tests

LINK-BELT's recommendation of the best drive or conveying chain for your machine is based on experience gained in field tests under actual working conditions. And Link-Belt is in the best position to make unbiased proposals because our line of chain, sprockets and attachments is *complete*. Horsepower, loading, speed, impact—every requirement can be met to enable your machine to maintain rated performance and efficiency throughout its life.

Yes, Link-Belt's unmatched facilities, experience and services are your best assurance of quality chain, properly applied. Next time you're considering a drive or conveyor application, our chain specialists will be glad to work with your engineers. For facts and prompt service, call your nearby Link-Belt office.



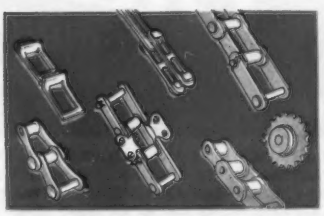
ACCURATE MANUFACTURE — Modern specialized machines allow the economies of large-scale production. Continuous inspections safeguard tolerance and finish of every link of chain. With these extensive facilities, Link-Belt has ample capacity to meet your production schedules.

LABORATORY CONTROL — Every chain bearing the Link-Belt trade mark meets rigid uniformity specifications. Our modern laboratory continuously explores new refinements to increase chain life. It is located at the world's largest plant manufacturing drive and conveying chain.

LINK-BELT

14,513

CHAINS AND SPROCKETS



COMPLETE LINE of agricultural chains, sprockets and attachments permits cost-saving specialization — offers the right chain for all conveyor and drive needs.

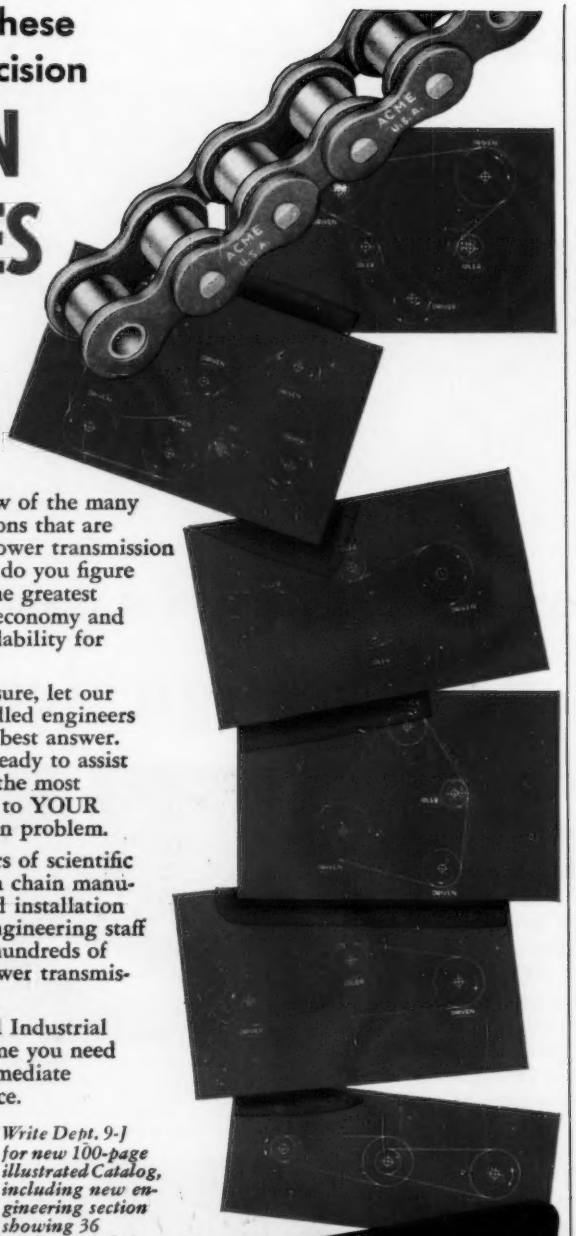
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

For more facts circle No. 72 on reply card

Which of these ACME Precision

CHAIN DRIVES

will help you drive it better?



Here are just a few of the many chain drive positions that are unsurpassed for power transmission efficiency. Which do you figure would give you the greatest efficiency, lowest economy and longer-life dependability for your application?

To be absolutely sure, let our staff of highly skilled engineers help you find the best answer. They are always ready to assist you in obtaining the most desirable solution to YOUR power transmission problem.

With over 30 years of scientific research, precision chain manufacturing skill and installation experience, our engineering staff has helped solve hundreds of tough-to-crack power transmission problems.

Contact your local Industrial Distributor anytime you need *"any"* kind of immediate Acme Chain service.

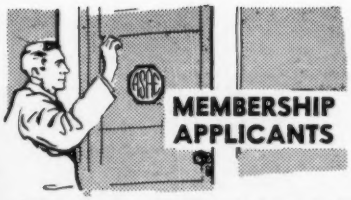
Write Dept. 9-J for new 100-page illustrated Catalog, including new engineering section showing 36 methods of chain adjustments.

Call **ACME** for Service

Acme Chain Corporation
HOLYOKE
MASSACHUSETTS

COMPLETE LINE OF ROLLER CHAINS AND SPROCKETS • DOUBLE PITCH CONVEYOR CHAINS • STAINLESS STEEL CHAINS • CABLE CHAINS • FLEXIBLE COUPLINGS • STANDARD AND SPECIAL ATTACHMENTS

For more facts circle No. 87 on reply card



MEMBERSHIP APPLICANTS

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Alexander, Carl A.—Asst. farm elecn. engr., Wisconsin Electric Power Co., Racine, Wis. (Mail) 2415 Delaware Ave.

Anderson, Sidney E. — Engr., John Deere Des Moines Works, Engineering Dept. Bldg. 8, Des Moines, Ia.

Backus, Donald A.—Instr., agr. eng. dept., State College of Washington, Pullman, Wash.

Barnes, John C. — Patent examiner, U.S. Patents Office, U.S. Dept. of Commerce, Washington 25, D.C. (Mail) 2816 31st St., S.E.

Choat, Lyle L. — Proj. engr., International Harvester Co. (Mail) P.O. Box 39B, R.R. 2, Naperville, Ill.

Coffman, David R.—Sr. eng. aide, irrigation dept., University of California, Davis, Calif. (Mail) 592 E. 10th St.

Davila, Rene O.—Res. asst., agr. eng. dept., University of Puerto Rico (Mail) P.O. Box 1105, Mayaguez, Puerto Rico

Eby, Harry J. Jr. — Agr. engr., AERD, USDA, Plant Industry Station, Beltsville, Md. (Mail) 5904 67th Ave., Riverdale.

Forsyth, Warren—Sales mgr., irrigation div., R. M. Wade Co., 1919 N.W. Thurman, Portland, Ore.

Frost, Duaine H.—District zone mgr., International Harvester Co. (Mail) 619 6th Ave., Lewiston, Ida.

Gillis, Benton T.—Test engr., International Harvester Co. (Mail) 610 N. Washington St., Naperville, Ill.

Hatch, Bonnie M.—Rep., Louisiana Power & Light Co., Winnsboro, La.

Hetzroni, Gad — Res. engr., Israel Farm Machinery Institute, Haifa, Israel (Mail) P.O. Box 4909

Hoeksema, Joe H.—Engr., John Deere Des Moines Works, Des Moines, Ia. (Mail) 4043 40th St.

Hoffman, John E. Jr. — Jr. engr., John Deere Spreader Works, East Moline, Ill. (Mail) 3720 10th Ave. Ct., Moline, Ill.

Howell, Richard A.—Territory mgr., John Deere Plow Co., Portland, Ore. (Mail) 119 Okanagan, Wenatches, Wash.

Immesoete, Arthur J. — Sr. engr., John Deere Planter Works, 501 3rd Ave., Moline, Ill.

Jensen, Clarence D.—Principal vocational instr. and head, agr. mech. dept., Fresno State College, Fresno, Calif. (Mail) 4949 N. Wishon Ct.

Johnson, Edward M.—Engr.-in-charge, Fibre Products Laboratory, Line Material Industries, 12th and Madison Aves., South Milwaukee, Wis.

Johnson, Herbert C. — Sales mgr., John Deere Planter Works, 501 3rd Ave., Moline, Ill.

Johnson, John H.—Watershed conservationist, SCS, USDA, P.O. Box 1898, Fort Worth, Texas

Johnson, Warren E. — Engr., John Deere Des Moines Works, Eng. Dept. Bldg. 8, Des Moines, Ia.

Kautz, Harold M. — Watershed planning spec., SCS, USDA, Fort Worth, Texas (Mail) 4217 Lovell

Kuhnen, Leo H.—Engr., Massey-Harris-Ferguson Co., Ltd. (Mail) 159 Kolnerstr., Koln-Westhoven, Germany

(Continued on page 830)

BURLAP BULLETIN

News about packaging and agricultural and industrial developments in burlap

The Bag Picture at the Hunterdon G.L.F.

"Filling, stitching and tagging, burlap bags have more 'give' and can be dragged around," says Donald Washburn, Manager

of the Hunterdon G.L.F., Flemington, N. J. "We like the bag that doesn't have to be handled gently and stacks without slipping.

Our men can work faster loading and unloading with burlap bags that are easy to grab and can be tossed without bursting.

Besides feed, we sell seed in burlap, too. See what a neat, strong package this bag of seed oats makes. No tearing—no spilling.

This is grist that our dairy farmers have brought in which we have ground and mixed with molasses. We're here to serve

the farmer and he likes to get his supplies in the bag that's *tough;* and, thanks to our return bag system, is the most economical."

Says Henry Bundt (left), poultryman of Lebanon, N. J., "I get my feed at the Hunterdon G.L.F. in *burlap bags.* Then I return the empties and get credit for each. Our feed bags are tossed in the truck, dragged around and carted out to the chicken houses. Burlap bags can sure take rough handling."

For operating efficiency burlap bags save time and trouble. For economy, a return bag system is *the key to lower feed costs.* If there is no return bag plan in your area write to The Burlap Council, 122 East 42nd Street, New York 17, N. Y.

Published by THE BURLAP COUNCIL of the Indian Jute Mills Association

For more facts circle No. 73 on reply card

. . . Membership Applicants

(Continued from page 828)

LaPlue, Lawrence D. Jr. — Instr. of agr. eng., Louisiana Polytechnic Institute (Mail) 1117 Carey St., Ruston, La.

Larson, Floyd D.—Engr., North Central Engineers, James, N. D. (Mail) P.O. Box 987, Minot, N. D.

Lichti, Robert W.—Engr.-in-training, Caterpillar Tractor Co. (Mail) 213 Radisson Rd., Marquette Hts., Pekin, Ill.

Mickelson, Rome H. — Agr. engr., ARS, USDA, P.O. Box 806, Grand Forks, N.D.

Mielock, Philip J. — Grad. student asst., Michigan State University, East Lansing, Mich. (Mail) 1019 B Birch Rd.

Miller, Howell M.—Rural sales rep., Louisiana Power & Light Co., Hammond, La. (Mail) P.O. Box 158 BB, R.R. 2

Mitchell, J. Kent—Agr. engr., SCS, USDA, Marion, Ia. (Mail) Indian Acres Trailer Park, 8601 Dyer St., El Paso, Texas

Morrison, Howard E. — Agr. engr., SCS, USDA, P.O. Box 504, Orangeburg, S. C.

Onulak, Eugene W. — Chief engr., Locke Steel Chain Co., 1230 Sabine St., Huntington, Ind.

Ortegon, Luis J. R.—Olarte Oapina Arias and Payan, Bogota, Colombia, S. A. (Mail) Diagonal 60 No. 21-58

Osmaston, R. S.—Des. engr., Sir Alexander Gribb and Partners, Toronto, Ontario, Canada (Mail) Lowfold, Wisboro' Green, W. Sussex, England

Parker, W. Russell — Architect, AERD, USDA, Plant Industry Station, Beltsville, Maryland

Person, Nat K. Jr.—Grad. training, Allis-Chalmers Mfg. Co., Independence Works, Independence, Mo. (Mail) 2708 S. Appleton

Piekos, Josef J. Jr. — Owner-operator, Cheshire, Mass. (Mail) Adams, Mass.

Powrie, William D. — Asst. prof., agr. eng. dept., Michigan State University, East Lansing, Mich.

Rice, Robert E.—Agr. engr., TVA, P.O. Box 401, Tupelo, Miss.

Steed, Glenn L. — Soil classification spec., Irrigation Extension, Alberta Department of Agriculture, Lethbridge, Alberta, Canada (Mail) 3113 11th Ave. S.

Stevenson, Paul N.—Assoc. prof., agr. eng. dept., Kansas State College, Manhattan, Kans.

Tanis, Dale R. — Draftsman, International Harvester Co., East Moline Works (Mail) 2230 11th Ave., Moline, Ill.

Thompson, Victor J. — Plant production engr., McMillen Feed Mills, Central Soya Co., Inc., Marion, Ohio (Mail) 352 S. Main

Tyler, Carrol L.—Asst. irrigationist, agr. eng. dept., University of Idaho (Mail) 309 4th St., South, Rupert, Ida.

Uy, Juan B.—Asst. superintendent of const. and instr. in agr. eng., University of Philippines, College of Agriculture (Mail) Agr. Eng. Dept., Cornell University, Riley-Robb Hall, Ithaca, N. Y.

Warren, Robert J.—Field engr., LeTourneau-Westinghouse Co., 2301 N. Adams St., Peoria, Ill.

Williams, J. A.—Mgr., B and M Wholesale Co., Inc., P.O. Box 128, Caldwell, Ida.

Wilson, Jack D. — Grad. asst., agr. eng. dept., Michigan State University, East Lansing, Mich.

Wilson, Warden F.—Sales, Pittsburgh Forgings Co., Coraopolis, Pa. (Mail) P.O. Box 36, Marietta, Pa.

Zarkhi, Avraham—Res. engr., Israel Farm Machinery Institute, Haifa, Israel (Mail) Ein Harod, Israel

Transfer of Grade

Boving, Peter A.—Asst. spec., irrigation dept., University of California, Davis, Calif. (Associate Member to Member)

Brooks, Lynndon A.—Proj. leader, agr. eng. dept., University of Wisconsin, Madison 6, Wis. (Associate Member to Member)

Brown, Kenneth E.—Engr., John Deere Waterloo Tractor Works, Waterloo, Iowa (Mail) 4215 Hillside Drive, Cedar Falls, Iowa (Associate Member to Member)

Burford, James B.—Hydraulic engr., proj. leader, ARS, USDA, agr. eng. dept., Virginia Polytechnic Institute, Blacksburg, Va. (Associate Member to Member)

Campbell, Joseph K.—Designer, New Holland Machine Co. (Mail) P.O. Box 91, New Holland, Pa. (Associate Member to Member)

Eaton, William C.—Design engr., Midland Steel Products Co., Owosso, Mich. (Mail) 6500 Collins Rd., R.R. 1, Henderson, Mich. (Associate Member to Member)

Goolsby, Harold B.—Ext. engr., Georgia Agricultural Extension Service (Mail) 202 Gran Ellen Drive, Athens, Ga. (Associate Member to Member)

Hamilton, J. R.—Head, agr. education dept., East Texas State College, Commerce, Texas. (Affiliate to Associate Member)

Harms, Harold F.—Farm service rep., British Columbia Electric Co., Ltd., P.O. Box 670, Abbotsford, British Columbia, Canada (Affiliate to Member)

Layer, John W.—Asst. prof., agr. eng. dept., Cornell University, Riley-Robb Hall, Ithaca, New York (Affiliate to Associate Member)

Monke, Edwin J. — Instr., agr. eng. dept., University of Illinois, Urbana, Ill. (Associate Member to Member)

Shepstone, Clayton M.—Sales engr., Mechanics Universal Joint Co., 2020 Harrison, Rockford, Ill. (Associate Member to Member)

Wallace, Reynolds E. Jr.—Vice-pres. and mgr., Wallace Pump and Supply Co., Inc., P.O. Box 717, Brundidge, Ala. (Associate Member to Member)

Phone Van Buren 6-0800

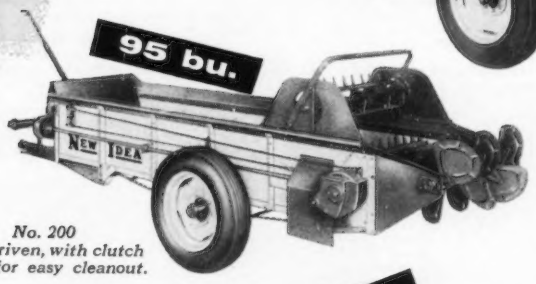
AMERICAN SPRING & WIRE SPECIALTY CO.

Manufacturers of All Type of Coil and Flat Springs, Wire Forms, Single and Double Rake Teeth and Light Stampings

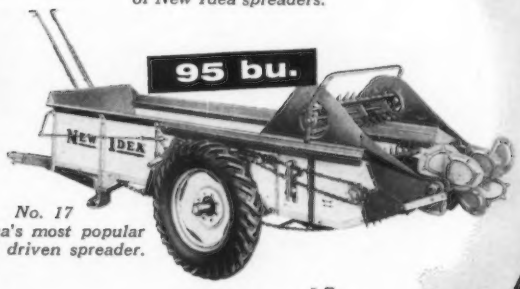
816-848 N. SPAULDING AVENUE CHICAGO 51, ILL.

For more facts circle No. 83 on reply card

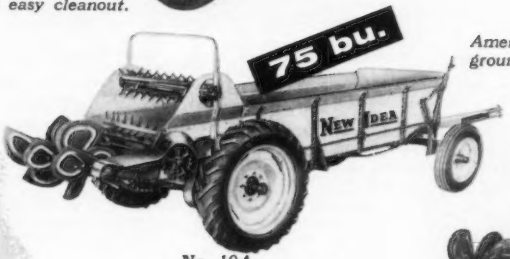
No. 19
PTO driven, the giant of New Idea spreaders.



No. 200
PTO driven, with clutch for easy cleanout.



No. 17
America's most popular ground driven spreader.



No. 10A
For tractor or team. Steel wheels or rubber tires.

No. 18
Low priced—high quality spreader.

YOU COULDN'T THINK OF A MORE COMPLETE LINE TO MEET THE VARIED NEEDS OF YOUR CUSTOMERS THAN THESE

NEW IDEA spreaders!

Only NEW IDEA offers five models—PTO or ground driven—capacities from 70 to 125 bushels—a wide range of prices.

All of them give top performance under a wide variety of field conditions—proven by extensive on-the-farm testing—further proven by rugged torture track testing of the four newest models.

Implement dealers know that more farmers prefer NEW IDEA, that year after year farmers buy more NEW IDEA spreaders than any other make.

So, if you want more spreader business, LOOK at NEW IDEA—it offers you more sales and parts opportunities, more profit.

FULL YEAR GUARANTEE ON NEW IDEA SPREADERS!

Your customer gets a written full year guarantee—proof that New Idea's interest in him will continue after the sale. Should any part of a spreader fail under normal operation during the first full year of use, New Idea exchanges the part free.

NEW IDEA FARM EQUIPMENT COMPANY
COLDWATER, OHIO Dept. J-117
DIVISION Avco DISTRIBUTING CORPORATION

PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listings.

POSITIONS OPEN—JUNE—O-189-729, 170-730. AUGUST—O-183-734, 196-735, 248-736, 255-737, 259-738, 265-739. SEPTEMBER — O-267-741, 267-742, 267-743, 267-744, 281-745, 292-746, 264-747, 264-748. OCTOBER—O-272-749, 334-750, 334-751, 339-752, 339-753, 336-754, 314-755.
POSITIONS WANTED—JUNE—W-186-11, 171-12, 180-13, 190-14. JULY—W-193-15, 192-16, 238-17. AUGUST—W-206-18, 254-22, 239-23, 256-25, 261-26. SEPTEMBER—W-278-27, 276-28, 262-29, 288-30, 296-31, 286-32, 299-33, 290-34. OCTOBER—W-289-35, 326-36, 335-37, 331-38, 340-39, 341-40, 301-41, 297-42.

NEW POSITIONS OPEN

PRODUCT ENGINEERS to design frameless, rigid-frame and truss-type prefabricated steel buildings with a leading manufacturer in Midwest. Age, about 25. BS deg in agricultural engineering, with major in farm structures. No previous industrial experience required. Prefer writing ability and interest evidenced by past activity. Desire to work in structural design. Company practices policy of "promoting from within." Salary $500 per mo. O-350-756

SALES ENGINEER to call on customers in railroad, highway and heavy construction markets to sell metal drainage structures with a leading midwestern manufacturer. Initial year in training program at home office in Midwest. Could then be assigned to any section of U.S. Age, about 25. BS deg in engineering. No experience required. Must be personable, aggressive, and interested in sales work. Future military obligations not necessarily an obstacle. Company "promotes from within." Salary $475 per mo. O-350-757

AGRICULTURAL ENGINEERS, also mechanical and electrical engineers, (several) for work in product research, design and development of farm tractors and construction equipment. Advanced design, product design, design analysis, research, stress analysis vibration, lab and field testing. Large manufacturer. Midwest locations. Age 24-40. BS or MS deg in agricultural, mechanical or electrical engineering, with mathematics through calculus, and machine design courses. Farm background and design and test experience desirable but not essential. Ability to work with others, and interest in work on farm tractors and construction equipment. Variety of opportunities for advancement, on proof of ability to assume increased responsibilities. Salary open. O-360-758

ENGINEERING SCIENTIST for mechanical laboratory research and development on engines, farm power, power transmission and road building equipment with large manufacturer in Midwest. Age, under 30. MS or BS deg in agricultural or mechanical engineering. No experience required. Creative mind, with interest in research. Opportunity to advance in expanding central research laboratory activity of the company. Salary open, with provision for cost of living bonus. O-369-759

ENGINEERS for flood control, water resources and related work with natural resources council of a midwestern state. BS or MS deg in civil, agricultural or hydraulic engineering, with experience in water resources or hydraulic engineering work. Physical capacity for field work. Good opportunity for advancement. Salary $5700-7500. O-362-760

TECHNICIANS to maintain and direct mechanical field units in Republic of Ghana, Africa. Age, 30-55. Deg in agricultural engineering, or in agriculture with emphasis on engineering or soils. Experience 5 to 8 years. Ability to work with underdeveloped people. Salary $6000-7500 base plus 25 percent overseas differential. Increases possible on 6-month basis. Housing free. O-379-761

AGRICULTURAL ENGINEER for methods improvement work with large agricultural producer in Central America. Includes surveys of needs and establishing programs and projects for methods improvement on farms and shipping facilities. Age, 35-45. Graduate agricultural or industrial engineer. Experience in materials handling, methods engineering, or mass-production of agricultural products. Good executive, intelligent, persuasive, aggressive, and capable of growth. Unlimited opportunity. Salary, excellent. O-380-762

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER for sales engineering in power and machinery, farm structures, or irrigation and crop drying equipment with manufacturer or distributor, preferably in South. Will travel. Married. Age 25. No disability. BSAE, 1954, University of Arkansas. Farm background. Summer work experience with USDA, highway department, and construction trades. Sales engineer on irrigation, crop drying, other farm equipment and steel buildings, 2½ years. Active commissioned service in USAF, in supervision of steel building and airfield construction. Available now. Salary open. W-337-43

AGRICULTURAL METEOROLOGIST for development and/or operational work in application of meteorology to agriculture, any location. Married. Age 20. No disability. BSA, 1953, California Polytechnic Institute. Certificate of competency in meteorology, June, 1954. Expect MS deg in meteorology in August, 1958, University of California, Los Angeles. Active commissioned service in USAF, nearly 4 years, with experience as meteorologist. Available August, 1958. Salary $6000. W-320-44

AGRICULTURAL ENGINEER for sales or management in power and machinery or soil and water field with manufacturer or distributor, any location. Will travel. Married. Age 38. No disability. BSA, University of British Columbia. Farm background. Farm equipment retail store manager, 3 years. Sales engineer 2 years with wholesale distributor of marine and industrial engines, pumps and irrigation equipment. Wholesale distributor one year. Manufacturer's agent 2 years. War service in Air Force 5 years as flight engineer. Available January, 1958. Salary $6000. W-344-45

AGRICULTURAL ENGINEER for engineering sales or development in power and machinery field with manufacturer or distributor, preferably in Midwest or Northeast. Will travel. BSAE, Michigan State University. Married. Age 32. No disability. Design and development of farm equipment 5 years. Territory manager for wholesale distributor of farm equipment over 2 years. War service nearly 2 years as aviation cadet. Available on two weeks notice. Salary open. W-355-46

AGRICULTURAL ENGINEER for design, development and research in power and machinery with manufacturer or consultant, preferably in vicinity of Kansas City, Mo. Single. Age 34. No disability. BSAE, 1952, University of Missouri. Experience one year with SCS, over 4 years with consulting engineers in civil and municipal engineering fields. Registered professional engineer in Missouri. War enlisted service 2 years in Army. Available on 30 days' notice. Salary open. W-356-47

AGRICULTURAL ENGINEER for farm management, consulting or sales and service work in power and machinery, farm structures, rural electric or soil and water field with manufacturer, distributor, consultant or farming operation, in South, Southeast, or Latin America. Limited travel. Married. Age 33. No disability. BSAE, 1947, University of Florida. Farm background. Teaching 2 years. Land appraisal one year. Farm equipment sales and service one year. Agronomist with private industrial organization 5 years. Navy commissioned service 3 years. Available on 30 days' notice. Salary open. W-357-48

AGRICULTURAL ENGINEER for design, development, research or sales in farm structures or soil and water field with manufacturer, distributor, or consultant, in Northeast. Married. Age 24. No disability. BSAE 1955, University of Massachusetts. Experience as USAF installations engineer 23 months. Available November 25. Salary open. W-342-49

AGRICULTURAL ENGINEER for design, development, research, or service in power and machinery or product processing with industry or public service in Mountain West. Limited travel. Married. Age 30. No disability. BSA 1953, Montana State College. Experience 3½ years as bearing applications engineer specializing in applications on farm equipment. Design experience on aircraft ground support and low-temperature jet fuel storage equipment. Enlisted service in Navy 3 years. Available now. Salary open. W-291-50

ENGINEER AND GEOLOGIST for development, research, teaching, writing, or management in development of water resources and soil erosion control, with public service, manufacturer, or consultant. Any location. Married. Age 55. No disability. BS in Chemistry, civil engineering and geology, 1926, Colgate University. MS in Geology, 1933, Cornell University. Extensive experience in geology, chemical engineering, and soils. Available on two weeks' notice. Salary open. W-363-51

AGRICULTURAL ENGINEER for sales, sales development, promotion or service work in power and machinery or farm structures, with industry or public service, preferably in Southeast. Married. Age, 33. Vision corrected by glasses. BSAE, 1957, Alabama Polytechnic Institute. Experience one year in contract land clearing and earth-moving; 3 years as farm manager; 7 years pilot training. War enlisted and commissioned service in Army Air Corps, 2½ years. Available on 45 days notice. Salary open. W-371-52

CLOSED DIE FORGED
HITCH
by
FARM TOOLS DIVISION
PITTSBURGH FORGINGS CO.
1111 THORN STREET
CORAOPOLIS, PENNA.

Part Name—Tractor Hitch Material—C-1045
Average Weight—12 pounds Used on—Original equipment

Why a forging is used.....

This closed die forged tractor hitch is designed to absorb the shock loads common in its use. The eye and shank are forged from one piece so that the part contains no welds. Forging this tractor hitch produces a part at minimum cost and a part which can be varied in length to suit any specific application.

Pittsburgh's Forging Engineers specialize in the design of agricultural forgings. Let these Engineers design closed die forgings for your farm equipment.

For more facts circle No. 85 on reply card

AMES ABC SPRINKLER SYSTEMS, with the famous Ames Ball Coupler, are the most modern, economical revolving sprinkler systems on the market. Quickly converted to Tow-A-Line or Wheel-O-Rain mechanical move systems.

ONLY AMES offers a complete line of irrigation equipment for all irrigation methods: sprinkler, furrow and flood. Backed by factory guarantees and service, and installation "profit-planning"—locally and nationally—since 1910. Write for details.

AMES

"Profit-Planned" IRRIGATION SYSTEMS

W. R. AMES CO.

150 HOOPER STREET • SAN FRANCISCO 7, CALIF.

Since 1910 Denver · Indianapolis · Tampa · Sydney, Australia

For more facts circle No. 75 on reply card

A Handsome, Permanent Binder for AGRICULTURAL ENGINEERING

One copy **$2.80**

Two or more $2.40 each
Postpaid in U. S. A.
Foreign postage extra

THE ONLY binder that opens flat as a bound book! Made of durable, green imitation leather, nicely stamped on backbone with the name of journal and year and volume number, it will preserve your journals permanently. Each cover holds 12 issues (one volume). Do your own binding at home in a few minutes. Instructions easy to follow. Mail coupon for full information, or binder on 10-day free trial.

---------- MAIL COUPON TODAY ----------

THE SUCKERT LOOSE-LEAF COVER CO.
11911 Grand River Ave., Detroit 4, Mich.

Mail postpaid.....binders for Agricultural Engineering for years.....
Will remit in 10 days or return binders.

Name.....

Address.....

City.....State.....

KEEPS EVERYTHING COOL UNDER THE HOOD

Scorching heat creates ultra-tough conditions for this engine doing *2* jobs at once—pulling the rig *and* operating the P.T.O. baler.

YOUNG quality built radiators have the essential reserve capacity to keep the engine cool even when partially clogged by dust and chaff —the stamina to withstand the additional hazards of bone shaking going over the roughest ground. Conditions that would rapidly break up any radiator of inferior design or construction.

These super strength YOUNG radiators have restraining core side baffles, corner web reinforcing and many other exclusive structural features making them products of quality, readily accepted, relied upon and used by the nation's leading farm equipment manufacturers.

"WHERE QUALITY COUNTS"

Write today to Dept. 297-L for catalog 148-A. Your inquiry is welcome and there is no obligation.

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

For more facts circle No. 76 on reply card

Index to Advertisers

Acme Chain Corp. 828

American Spring & Wire Specialty Co. 830

W. R. Ames Company 833

Armco Steel Corp. 781

Bearings Co. of America Div., Federal-Mogul-Bower Bearings, Inc. 779

Bendix Aviation Corp. 823

Blood Brothers Machine Div., Rockwell Spring & Axle Co. 789

The Burlap Council 829

Clark Equipment Co. 780

Deere & Company 786-787, 811

Douglas Fir Plywood Assn. 834

Federal-Mogul Div., Federal-Mogul-Bower Bearings, Inc. 824

Hyatt Bearings Div., General Motors Corp. 782

Ingersoll Products Div. 792

Kaiser Aluminum & Chemical Sales, Inc. 813

Link-Belt Company ..... 2nd cover, 827

National Seal Div., Federal-Mogul-Bower Bearings, Inc. 777

New Departure, Div. of General Motors ..... 3rd cover

New Holland Machine Co. 821

New Idea Farm Equipment Co. 831

Pittsburgh Forgings Co. 832

Purolator Products, Inc. 775

Raybestos-Manhattan, Inc. Manhattan Rubber Div. 790

Rockford Clutch Div., Borg-Warner Corp. 822

Standard Stamping & Perforating Co. 834

Stephens-Adamson Mfg. Co. 817

The Texas Company 788

Timken-Detroit Axle Div., Rockwell Spring & Axle Co. 778

Timken Roller Bearing Co. ..... 4th cover

The Torrington Co. 785

U.S. Steel Corp. 791, 815

Weyerhaeuser Sales Co. 819

Wisconsin Motor Corp. 820

Young Radiator Company 833

ADVERTISING REPRESENTATIVES

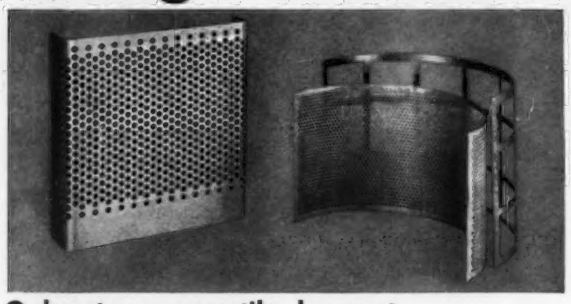
Chicago: DWIGHT EARLY & SONS, 100 North La Salle St. (Telephone: CEntral 6-2184)

New York: BILLINGSLEA & FICKE, 420 Lexington Ave. (Telephone: LExington 2-3667)

Los Angeles: JUSTIN HANNON, 635 So. Kenmore Ave. (Telephone: DUnkirk 5-3993)

Advertising Manager: RAYMOND OLNEY, 420 Main St., St. Joseph, Mich. (Telephone: YUkon 3-2700)

Catalog of Good Ideas!



Order strong, versatile, low cost

perforated metal from Standard Stamping's NEW catalog!

Use perforated metal on all farm equipment for better

- screens
- guards
- steps
- seats
- grilles
- small parts

Catalog shows hundreds of hole sizes and patterns, makes ordering easy! (For manufacturers only.) If the equipment you manufacture requires perforated metal of any size, thickness or pattern **Attach this ad to your letterhead for your free copy!**

STANDARD STAMPING & PERFORATING CO.
3131 W. 49th Street, Chicago 32, Illinois
Phone: HEmlock 4-6600

For more facts circle No. 80 on reply card

FREE

1957 EXTERIOR PLYWOOD FARM CATALOG

Valuable 20-page illustrated reference catalog lists over 40 plans available from agricultural schools, Midwest Plan Service, Douglas Fir Plywood Association. All designs tested for efficiency, ease of construction. Write Douglas Fir Plywood Assoc., Tacoma, Wash. (Offer good in USA only.)

PARTIAL CONTENTS: Hog Houses and Equipment • Cattle Feeders • Calf Shelters • Poultry Houses and Equipment • Grain and Feed Bins • Nut Dryers • Many Others.

USE ONLY EXTERIOR Fir Plywood for all farm construction

EXT-DFPA® MEANS WATERPROOF GLUE

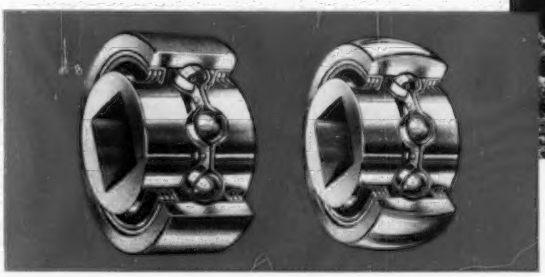
For more facts circle No. 81 on reply card

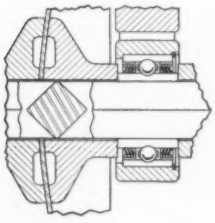
ND FACTS

DIRT SEALED OUT GREASE SEALED IN

With New Departure heavy duty disc bearings, the performance proved triple lip seals keep lubricant *in* bearings—dirt, dust and wear sealed *out.*

Here is new bearing dependability . . . virtually service-free operation . . . for disc harrow buyers. Bearings are available with cylindrical or spherical outer rings, and square or round bores—outstanding examples of bearings engineered by New Departure to simplify mounting design and cut machinery costs. Remember, too, experienced New Departure sales engineers are always at your service.



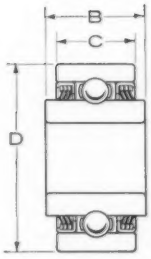


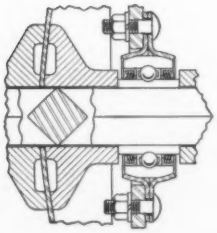
TYPE II

DIMENSIONS — TYPE II — CYLINDRICAL O.D.

Bearing No.	Shaft Size II		O.D. +.000 −.001	Ring Widths ±.005	
Sealed	Nominal	Max.	D	Inner B	Outer C
AS4508AD	1" Square	1.035	3.150	1.688	1.312
AS4508BD	1⅛" Square	1.120	3.150	1.688	1.312
AS4509AD	1¼" Square	1.285	3.346	1.688	1.312
AS4511AD	1½" Square	1.536	4.000	1.750	1.438
AS4508ED	1½" Round	1.535	3.150	1.688	1.312

For easy, simple mounting in cast housings. Square or round bore. Prelubricated and sealed for life.



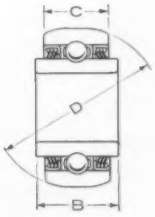


TYPE III

DIMENSIONS — TYPE III — SPHERICAL O.D.

Bearing No.	Shaft Size III		Spherical O.D. ±.005	Width ±.005	
Sealed	Nominal	Max.	D	Inner B	Outer C
AS4508FC	⅞" Square	.905	3.438	1.688	1.312
AS4508AC	1" Square	1.035	3.438	1.688	1.312
AS4508BC	1⅛" Square	1.120	3.438	1.688	1.312
AS4511AC	1½" Square	1.536	4.125	1.750	1.438
AS4508DC	1⅛" Round	1.192	3.438	1.688	1.312
AS4509BC	1¾" Round	1.780	3.438	1.688	1.312

Spherical outer ring for alignability in flange mounting, square or round bore, prelubricated and sealed for life.



GM FORWARD FROM FIFTY

Send for complete details on Heavy-Duty Disc Bearings

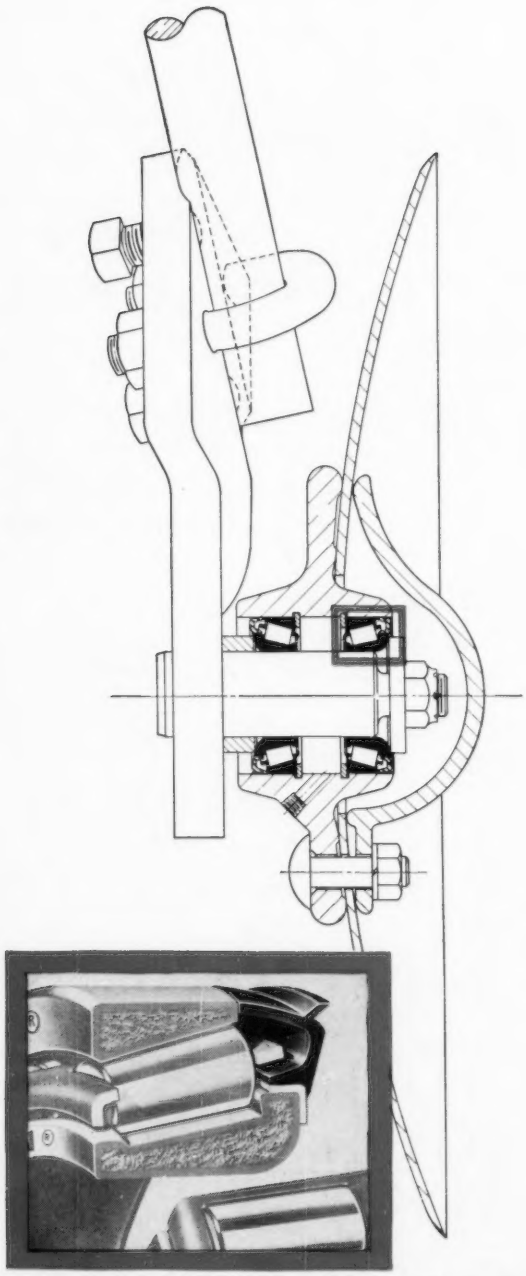
ND NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

For more facts circle No. 78 on reply card

Disc jointer manufacturer switches to Timken® bearings with new "Duo-face" seal



Gets 2-way sealing, cuts assembly costs, saves space

ALREADY major implement manufacturers are switching to Timken® bearings with the new Duo-face seal, introduced only last August. This new seal does a better job because it seals two ways. It reduces assembly costs because it comes already assembled on the bearing inner race. And it also saves space because it adds practically nothing to the width of the bearing. How one manufacturer is using it on a disc jointer is shown at left.

SEALS 2 WAYS. The new Duo-face is the only anti-friction bearing seal combining the advantages of an O.D. and a face type seal. One lip of the seal operates against the bearing housing bore, providing an O.D. seal. The other against the smooth, flat, hardened surface of the bearing cup face.

CUTS ASSEMBLY COSTS. Pre-assembly of the seal on the cone eliminates mounting of the seal and bearing in separate operations. There are no special handling or assembly problems. No special tools or fixtures are needed. There are no extra installation costs. And when the bearing is removed from a machine there's less chance of damaging the seal.

SAVES SPACE. The new Duo-face seal takes up less space than conventional seals, permits more compact hub and housing designs. Yet it does not limit lubricant capacity.

PROVED PERFORMANCE. The Timken Company Duo-face seal has been field-tested and proved on tractor front wheels, implement wheels, disc jointers, disc plows, disc harrows, coulters, side delivery hay rakes and conveyor idlers.

Timken bearings with assembled Duo-face seals are available in the following bore sizes: .7500″, .8437″, 1.0000″, 1.2500″, 1.3750″, 1.5000″ and 2.6875″. For information, call your nearby Timken Company sales engineer or write: The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

See the next Timken Televent hour, "The Innocent Years" over NBC-TV, Thursday night, November 21st.

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭
BEARING TAKES RADIAL ↕ AND THRUST ↔ LOADS OR ANY COMBINATION ✳

The farmer's assurance of better design

Tapered Roller
TIMKEN BEARING
EQUIPPED

For more facts circle No. 79 on reply card